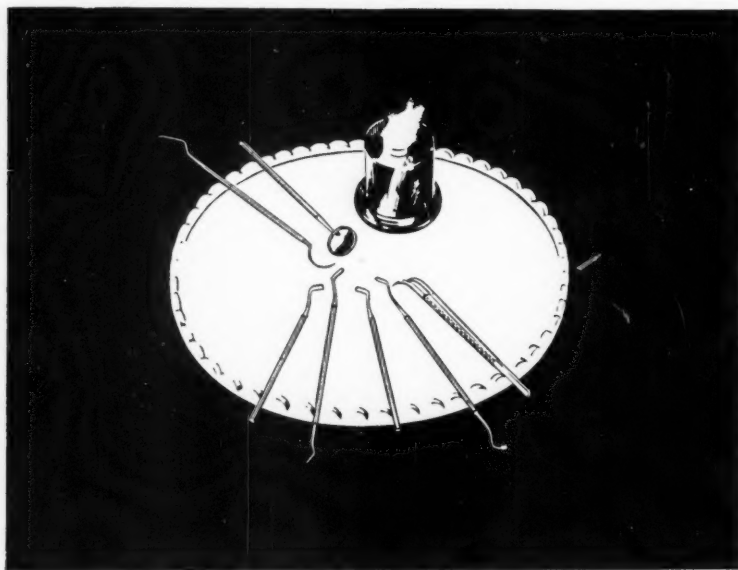


*The*  
**DENTAL  
JOURNAL**  
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VOLUME - - 22  
NUMBER - - 1  
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Vol. 22

January, 1950

No. 1

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Editor: ROBERT HARRIS, M.D.S.

Published by the Australian Dental Association (N.S.W. Branch)  
B.M.A. HOUSE, 135-137 MACQUARIE STREET, SYDNEY

Communications intended for publication in "The Dental Journal of Australia" should be addressed to the Editor. All advertising and business matters should be directed to the Secretary.

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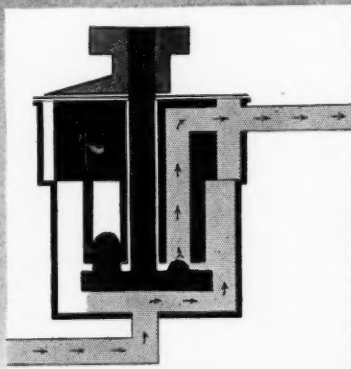
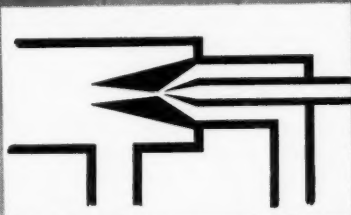
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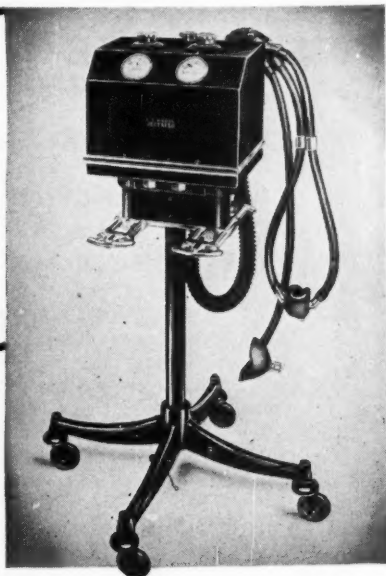
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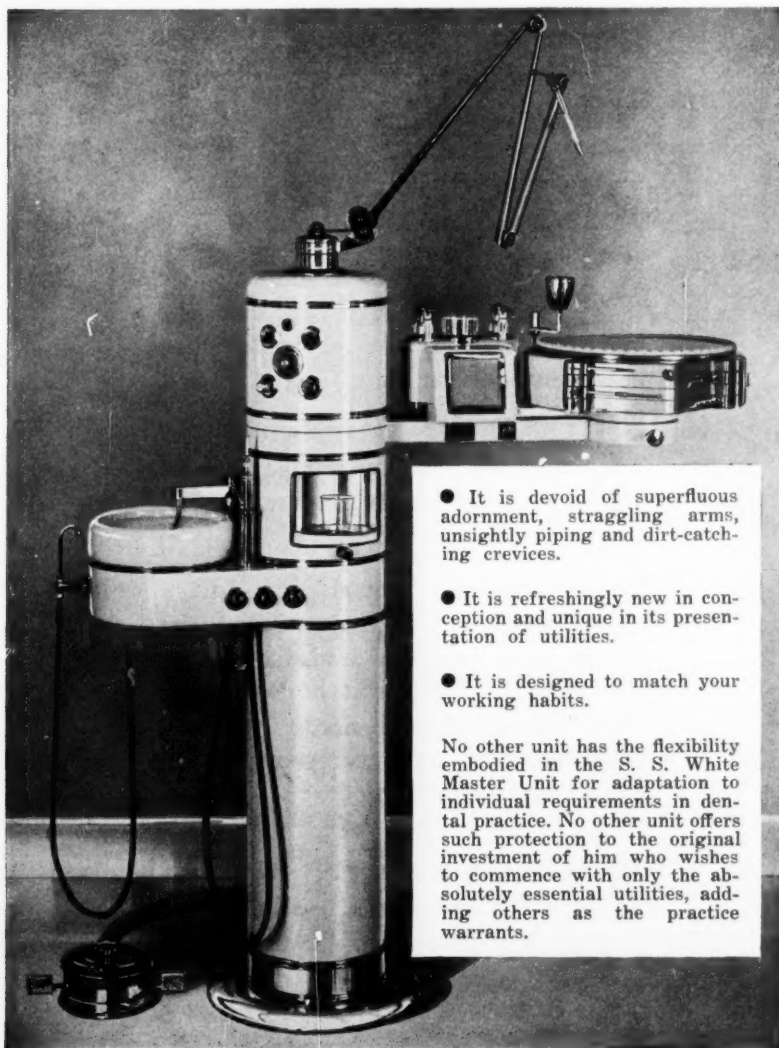
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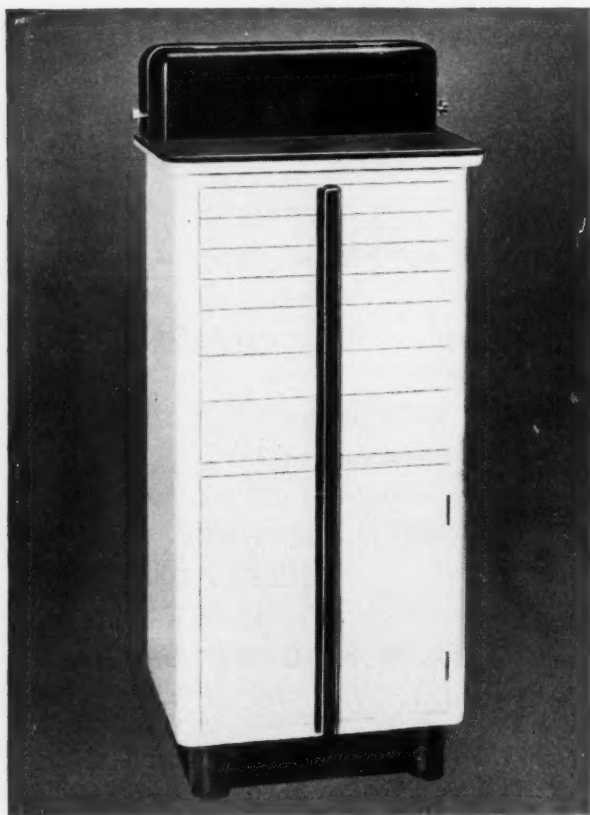
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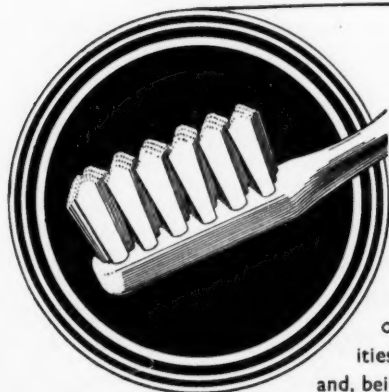
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## **STANDARD SPECIFICATIONS AND TECHNICAL PROCESSES IN ACRYLIC RESINS FOR DENTISTRY\***

Alan R. Docking, M.Sc.(Melb.), A.A.C.I.,  
Commonwealth Bureau of Dental Standards, Melbourne University.

### **Introduction.**

It is perhaps a truism to say that the introduction of methyl methacrylate resins represents one of the most important advances in dentistry. The history of the establishment of acrylic resins in the dental profession is a fascinating one and their properties and applications are adequately discussed in the very extensive literature now available. The maintenance of the present standard, efforts to improve it, and new applications of acrylic resins form the subject of this paper. Briefly, two aspects will be stressed:

1. Recent developments,
2. Standardisation.

### **Recent Developments.**

At the outset it may be said that there has been little, if any, recent improvement in the properties of acrylic resin itself. Its chief disadvantages of relative softness when compared with tooth enamel, dimensional changes on processing, and susceptibility to attack by organic liquids still apply. The chief developments that will be described are new applications of the material, particularly in respect to the possibility of its use without the necessity of curing by the external application of heat. For convenience the field has been divided into divisions which will be discussed in turn.

### **Denture Base and Bridge Materials.**

**REQUIREMENTS:** The various requirements for a good denture base material are so well known that there is no necessity to reiterate them here. There is no ideal denture base material, although polymethyl methacrylate resin is regarded by most practitioners as the nearest approach to date. Where it fell short of the ideal six or seven years ago, it still falls short today, although there have been numerous attempts and suggestions made to improve it.

**COPOLYMERS:** One method tried for improving strength and other properties is by the use of copolymers. By this means ethyl methacrylate, styrene, or

\*Based on a lecture delivered to the A.D.A. (N.S.W. Branch) Meeting, August, 1949.

vinyl compounds are co-polymerised with the methyl methacrylate to confer certain superior properties on the final product. Frequently, however, what is gained on the roundabouts is lost on the swings. For instance, increased hardness can usually be obtained only at the expense of increased brittleness and greater difficulty in processing.

From the dental point of view, methyl methacrylate has the best properties of the whole family of acrylates, although it is contended by some that improvement in toughness is effected by co-polymerisation with ethyl methacrylate. This appears to have been done with some of the overseas resins. We have not been able to demonstrate any appreciable change in hardness or transverse strength of these copolymers, although a recent report by Johnson and Matthews<sup>1</sup> indicates great improvement in the copolymer with respect to the resistance to fatigue failure. It is suggested that a person bites on an average of about half a million times a year, and the cracking of upper dentures down the midline, for example, would be expected to be least with the material giving the highest resistance to fatigue failure.

Other resins used for copolymers, particularly in the U.S.A., include other vinyls and styrene. These are often somewhat softer and slower curing and lend themselves to the so-called injection moulding of dentures.

A theoretically sound attack would be to co-polymerise with the acrylic monomer other monomers that are capable of forming cross-linkages. This would encourage the formation of a network harder and more resistant to heat, i.e., approaching the thermo-setting plastics. Such materials include the allyl compounds, allyl methacrylate for example, but the proportion of the allyl compound needs to be high to make any worth-while improvement in hardness, and some desirable properties are lost in the process.

**PLASTICISERS:** Apart from the use of copolymers, dental acrylic resins are kept relatively free from modifying agents because their optimum strength is achieved in the pure state. The lower proportion of plasticiser in dental acrylics distinguishes them from the commercial types. Some earlier dental acrylics did in fact contain fairly great amounts of plasticiser and, apart from the effect on mechanical properties, cases of marked idiosyncrasy in some patients to such materials are known<sup>2</sup>.

**RADIOTRANSLUCENCY:** In some cases the addition of modifying agents may be necessary; for instance, in order to produce radio-opaque resins. Leader<sup>3</sup> achieved this by the use of brominated aliphatic hydrocarbons such as ethylene dibromide, and claimed that at the same time it conferred better mechanical properties on the final product.

**STRENGTHENERS:** The strength of plastics may be improved by the addition of mechanical strengtheners. Glass fibre and metal meshes have been suggested from time to time. The glass fibre should be thoroughly freed from oils and preferably dipped in an acrylic syrup before use. In order to make strengtheners truly effective it is essential that they do not merely lie in the neutral bending

<sup>1</sup> Johnson, W., and Matthews, E.—Fatigue tests on some dental resins. B.D.J. 86:252-3, 1949.

<sup>2</sup> Peachey, D. G.—Private communication.

<sup>3</sup> Leader, S. A.—Research and Progress in acrylics. B.D.J. 79:183-8, 1945.

plane. It may be difficult to ensure this in an actual denture. The experiments of Osborne<sup>4</sup> in England and Ware<sup>5</sup> at this Bureau with glass fibre strengtheners indicate that the improvement in transverse strength is neither great nor consistent.

**MAGNETIC REPULSION:** Although this is scarcely to be classed with strengtheners a recent British patent<sup>6</sup> has been issued whereby advantage is taken of the light weight of acrylic resin to incorporate magnets arranged in such a way that they repel when in position in the mouth. This is not as fantastic as it seems for fairly high magnetic fields are possible with some of the modern permanent magnet alloys.

**DIMENSIONAL CHANGE:** One of the chief disadvantages of acrylic resins is the dimensional change which takes place on curing. It seems impossible to avoid shrinkage, although actually some of this is compensated by the subsequent swelling of the denture in the oral fluids. (The subsequent swelling in water incidentally is less when an alginate separator had been used instead of tinfoil). One method that has been suggested by Sweeney and investigated by Steck<sup>7</sup> in the U.S.A. is to use a mould formed from a plaster which exhibits a high setting expansion (0.4 to 0.5 per cent), in the same way as expanding investments are used to compensate for the casting shrinkage of metals. In this way precision dentures were made. This technique has interesting possibilities but in applying it the difference between the effect of tinfoil and alginate should always be kept in mind.

**PARTIAL DENTURES AND BRIDGES:** Partial dentures and bridges have been included under this heading, but developments here apply more to design which is outside the scope of this paper. Acrylic resin has many aesthetic advantages for these purposes but the material must be regarded as still in the experimental stage. Unless a markedly stronger resin becomes available it is unlikely that acrylics will replace metal or baked porcelain restorations. Only in special cases should bridges be made of acrylic resin entirely. Usually it is used as a facing on metal retainers or is reinforced internally with metal; in both the latter instances the major stresses are borne by the metal. To obtain an equivalent strength using acrylic resin alone the appliance would be too bulky.

**Acrylic stains:** Reference could be made here to recently advertised self-curing acrylic stains for adjusting, where necessary, the shade of acrylic veneer facings, bridges, inlays, or jacket crowns. It is important, of course, to make sure that it has no adverse effect on the acrylic resin to which it is applied, if it does not have any such ill-effect and is instrumental in producing a correct and permanent shade it should prove a very useful product. Compatible opaque materials are also now available for masking bridge frame-work and veneers to prevent, according to the advertising literature, "that tell-tale grey" from showing through the acrylic.

<sup>4</sup> Osborne, J.—Transverse tests on denture base materials. B.D.J. 86:64-7, 1949.

<sup>5</sup> Ware, A. L.—Unpublished results.

<sup>6</sup> Goldschmidt, E. E.—Dentures. Brit. Pat. 605901, 1948. Aust. Pat. App. 8587/46.

<sup>7</sup> Steck, Naomi S.—Making the denture dimensionally accurate. Paper presented before the Dental Materials Group, I.A.D.R., 19th June, 1948. (*Typescript*).

**SEPARATING MEDIA:** In regard to separating media an interesting article appeared recently on tinfoil substitutes and their effect on acrylic denture materials. This confirms the observation noted at intervals that alginate materials sometimes cause whitening of the denture. This cloudiness appears to be due to the presence of moisture, presumably from the alginate film or from the plaster through the film; it does not occur when tinfoil is used. However, experiments at the National Bureau of Standards with monomer saturated with water and using moist, if not actually wet, conditions throughout failed to reproduce the whitening. In another experiment, dusting the surface of the uncured acrylic with benzoyl peroxide caused fogging of the specimens even when cured against tinfoil. Another deficiency of alginate tinfoil substitutes that the writers, Ferguson, Paffenbarger and Schoonover<sup>8</sup> point out is the severe stress that is induced on the surface of acrylic specimens processed against them as revealed by the application of a solvent to the surface. They found, moreover, that the alginate films did not always prevent the adherence of the resin and the gypsum, and stresses were more pronounced in such areas.

### Teeth, Inlays, Crowns.

**STATUS OF ACRYLIC RESIN:** As far as acrylic teeth are concerned much has been written regarding their comparison with porcelain either to their credit or discredit, often according to the commercial interests, if any, of the writer. Actually neither type is entirely satisfactory when the natural tooth is taken as a standard; it is a question of weighing up their familiar advantages and disadvantages for the particular application. A compromise between the completely organic tooth and the completely mineral porcelain tooth is indicated and this may yet be achieved by the use of those interesting materials, the silicones which are, in fact, intermediate in constitution and properties between the ceramics and the synthetic resins.

Shapiro<sup>9</sup> has suggested the possibility of co-polymerised resins intermediate between thermo-plastic and thermo-setting resins for use in the enamel portion of the tooth, and straight acrylics for the interior. He suggests using for the incisal or occlusal surface a copolymer of, say, glycol dimethacrylate and methyl methacrylate with the addition of minor proportions of colouring matter and a fluorescent pigment.

**HARDNESS:** The major criticism of acrylic teeth, inlays and crowns is on the score of hardness, and efforts are continually being made to improve this factor. It is the subject of much advertising, but claims for increased hardness are usually found to be unsubstantiated. It seems that if the resin has been properly cured and is, in fact, polymethyl methacrylate then the hardness will inevitably fall within a fairly narrow range. One possible exception is a recent sample that gave a Knoop hardness figure of 23 compared with 18 to 19 normally obtained with pure acrylic resins. However, as the Knoop hardness of enamel is about 260, the gain is relatively slight.

<sup>8</sup> Ferguson, G. W., *et al.*—Deficiencies of tinfoil substitutes in the processing of acrylic resin. J.A.D.A. 38:573-86, 1949.

<sup>9</sup> Shapiro, M. S.—Improved acrylic teeth based on a new structural and chemical concept. D.I.I. 10:596-9, 1948.



Hardness measured by indentation with a diamond or a steel ball is not necessarily a fair test, and in any case the figures, although perhaps useful as a comparison between two types of resin or two processes, are meaningless *when compared with human enamel*. Clinical evidence does not wholly confirm test data obtained by direct comparison of acrylic resin and human enamel in regard to hardness; obviously factors other than mere hardness are at work and should be taken into account. A resilient material may be more resistant to certain types of abrasion than a harder and more brittle one.

**FLUORESCENT ACRYLIC:** There has been some discussion about the appearance of artificial teeth under various lighting conditions; some acrylic teeth and acrylic powders for their preparation incorporate a small quantity of fluorescent material, it being pointed out that natural teeth fluoresce. It appears, however, that fluorescence is not the answer so much as the spectral distribution of the light dispersed by the pigments and resin. The chief trouble, it seems, is not when acrylic and natural teeth are compared in daylight but under artificial light. There is much less ultraviolet in the latter and hence less chance of fluorescence. Why then a fluorescent pigment? The only imaginable use is that it may improve the appearance of mouths under rather unnatural lighting conditions rich in ultraviolet.

**DISCOLORATION:** By all accounts, the staining or alteration in shade of acrylic teeth has caused some trouble although we have not had the opportunity to examine such failures in the laboratory. Tests have indicated that in some instances darkening may result from the action of sulphides in the food on the pigments used in the teeth, but very frequently the trouble seems to be due to decreased opacity of the tooth. Decreased opacity (increased translucency) will result in an apparent darkening depending on the pigment distribution in the tooth, metal backings, pins, etc. The opacity may be affected by moisture or by unstable pigments.

**CEMENTING OF INLAYS:** As far as inlays in particular are concerned one of the difficulties appears to be to develop a suitable cement to ensure retention in the cavity. Dentists may possibly have to break away completely from the now traditional cements, and work on this alternative is in hand. One possible method of obtaining good retention would be to provide very small undercuts in the cavity and on the acrylic inlay before insertion and use a so-called self-curing acrylic cement to complete the restoration<sup>10</sup>. However, further clinical investigation on this is essential.

#### Denture Relines and Repairs.

**"PERMANENT" LINERS:** The story of denture lining and repairing materials is the story of the search for resin for curing at room or oral temperature. What was first thought to be a solution to the problem turned out to be a failure for the true nature of the materials was soon revealed by work both at the Northwestern University<sup>11</sup> and at the National Bureau of Standards<sup>12</sup>. The materials were found to depege for their so-called curing on the escape of a solvent, such

<sup>10</sup> McLean, J. W.—Fixation of acrylic inlays by direct polymerisation. B.D.J. 84:76-9, 1948.

<sup>11</sup> Skinner, E. W. and Pomes, C. E.—Self-hardening lining materials. J.A.D.A. 32:419-30, 1945.

<sup>12</sup> Beall, J. R. and Caul, H. J.—"Liners" for dentures. J.A.D.A. 33:304-8, 1946.

as ethyl or amyl acetate, diethyl carbonate, chloroform, from a viscous liquid based on methyl methacrylate; actually this process took many days. The resulting hardened material was often miscalled a permanent liner.

The laboratory tests indicated that the liners had definite adverse effects on the base resin and, in any case, the solvents used were shown to be likely irritants to the soft tissue.

**SELF-CURING REPAIRS:** After the 1945-6 exposure of the true nature of the "permanent" liners there was a three or four year lull during which intensive research was being conducted on self-curing resins. In recent months there has been another outbreak but this time the attention has been fixed on denture repairs, with numerous side issues such as the preparation of individual trays, relining, replacing teeth. One of the earliest reports was by Brodsky<sup>13</sup> but it was not until a year later that a number of firms almost simultaneously commenced to advertise this kind of material. Similar claims are being made for the products such as "not hours but minutes for prosthetic repairing and relining", "repairs can be completed virtually while you wait". These materials are, in fact, self-curing in the sense that no external heat need be applied and they do not depend merely on the escape of a volatile solvent. The powder and the liquid has been described as a combination of methyl acrylic esters, and one feature of the reaction is the great amount of heat that is evolved on mixing the two. The hardness of the final product appears to depend partly on the generation of this heat which may be encouraged by vigorous mixing prior to application. In this way it differs from the usual powder-liquid method for denture bases where the mixing is only moderate.

**ACCELERATORS:** It is not certain what agent is added to cause the polymerisation of the acrylic resin at room temperature. Later an activator shall be mentioned that is used to lower the polymerisation temperature to enable direct restorations to be made by the application of moderate heat, but the initiation of the action at room temperature is something new. Nearly all of the products are advertised as curing in twenty minutes at room temperature. (The time at mouth temperature is less—about ten minutes being required). It is evident that whatever agent is used the polymerisation temperature is greatly lowered.

The only useful reference to the subject that we have found in the technical literature is one by Hagger<sup>14</sup> of Switzerland who mentions certain organic sulphinic acids. The reasons for his experimenting with these is interesting. It will be remembered that acrylic powders with spherical granules are formed by the polymerisation of the monomer while it is held as an emulsion. One of the effective catalysts for this polymerisation is known to be sulphurous acid and Hagger argued that if one could find a similar organic compound soluble in monomer it may also work. He claims he has found such a material in certain of the sulphinic acids such as *p*-toluene sulphinic acid, and that polymerisation takes place even at 20°C., although, of course, higher temperatures bring about the reaction much faster. Furthermore, he found that to develop maximum hardness some heating at 60°C. or above is indicated.

<sup>13</sup> Brodsky, R. H.—Rapid polymerisation of acrylic at room or body temperature. D.Dig. 54:210-2, 1948.

<sup>14</sup> Hagger, O.—New catalysts for the polymerisation of olefines at room temperature. Helv.Chim.Acta 31:1624-30, 1948.

Whatever the catalyst used as a basis of the new repair materials one commercial sample we have tested certainly cures with the powder and liquid mixed at room temperature, and considerable heat is soon generated. A Knoop hardness number of 12 was obtained on a repair and this figure rose to 16 after boiling the specimen, as compared with Knoop hardness figures of 18 or 19 usually found with dental acrylic resins. Actually the repair was not strong, supporting less than 1500 gm. load on a transverse test piece which normally takes about 5000 to 6000 gm. to break, but more tests will have to be carried out when more of the material becomes available.

There is little point at this stage in discussing manipulative details of how the material is used, for supplies are not yet available here. Taken all round, these materials, if at all practicable, will be valuable time-savers, but several points have to be established first, including:

1. Sufficient hardness and strength must be obtained.
2. There must be no undesirable effect on the rest of the denture such as surface crazing or warpage.

**REPAIRS:** Before leaving repairs it should be mentioned that considerable difficulty was experienced in the laboratory in obtaining reasonable transverse strength of repairs carried out in the normal way with the full cycle of heat curing. This also seems to apply even to practitioners experienced in prosthesis for, when invited to repair a broken test piece, strength of the same order of the original material was not achieved. The test adopted is admittedly severe. An ordinary acrylic transverse test specimen  $6\frac{1}{2}$  cm. by 1 cm. by 0.25 cm. is prepared and its transverse breaking load, which is of the order of 5000 to 6000 gm., is obtained. The broken pieces are then rejoined according to the technique under test. Using various acrylic resins and types of joins—butt, dovetail, etc., at first it was found that most of the repaired test pieces were breaking at about 2000 gm. or less. It was thought at first that this may be due to residual wax but extra care in its removal made no difference.

Again, it was thought that the fresh dough may have an adverse effect on the test piece causing crazing and cracking. Such surface defects may give rise to low values in transverse strength. The trouble appears to be in the opposite direction—there is too little union between the old and fresh material. Better joins result if the ends are just moistened several times with a minimum quantity of monomer and the acrylic dough packed somewhat before the stage usually recommended for denture packing, not too soon of course, but sufficient to cause more softening of the broken ends. Adopting this technique a strength of 5000 gm. was more frequently obtained<sup>5</sup>. It is essential in this technique to resist the temptation to use an excess of monomer in painting the broken ends, otherwise crazing of the denture may result.

#### Direct Restorations.

Resuming the discussion of self-curing resins we come to the search for the direct restoration which is simple yet effective, similar in appearance to the enamel, and compatible in respect to the tissues. Acrylic resins seem to be very suitable in some respects, but the difficulty is first to induce the polymerisation of the acrylic at mouth temperature and then to avoid shrinkage and porosity.

**FIRST ATTEMPTS:** Acrylic resins for direct restorations ante-date those for self-curing repairs. The earliest workable application was a German one but before describing this, something should be said about the efforts to use the ordinary powder and monomer which harden gradually at room temperature. How much polymerisation actually takes place under these conditions it is difficult to say. The method was suggested by Salisbury<sup>15</sup> at the beginning of 1943. It appears from his articles that ordinary liquid and powder was used and, if so, the monomer probably contained a stabilizer such as hydroquinone. Somewhat better results may have been obtained by using the unmodified liquid. The restoration was packed after mixing the powder and liquid for one minute when the mixture had the appearance of damp sand. Pressure was maintained on the restoration by the finger on slightly lubricated metal foil. After hardening, warm air was blown on the restoration and then the foil burnished with a warm ball instrument. Salisbury followed this with other papers suggesting improvements and refuting criticism of direct restorations; a list of references to the subject up to 1947 was given in one article<sup>16</sup>.

**FINE POWDER:** Meanwhile in England the first direct restoration material appeared on the market, the chief advance being in respect to the very fine particle size of the powder<sup>17</sup>. Salisbury also announced an improved product along the same lines, but it is doubted whether these unmodified materials had any wide acceptance due to frequent failures. The rate of hardening was too slow and it was found necessary to instruct patients not to eat for several hours and certainly not to bite on the restoration until the following day.

**GERMAN DEVELOPMENT:** German investigations<sup>18</sup> formed the basis of various patents granted in 1941-43, the chief reason for the search apparently being the development of a substitute for restorative materials then in short supply. The product had only reached the experimental stage by the end of the war and had been distributed to a number of dentists for trial.

**ACTIVATORS:** The basis of the work is the use of an activating substance to cause the benzoyl peroxide accelerator to act at lower temperatures. Earlier work resulted in the use of aromatic amines, but these caused discolouration. It was then found that aliphatic amines such as tributylamine, trihexylamine and trioctylamine were as satisfactory without discolouration. The reason for the activation is not clear, but the polymerisation process depends on the formation of active intermediate compounds or free radicals and the amines are said to form transient but reactive amine oxides which assist the process. A brief period of heating is necessary to start off the action so that it can be completed in a reasonable time. This "heat shock" may be applied by a hot spatula, blowing hot air, or by infra-red which is apparently much more effective. This type of material apparently forms the basis of the present English product<sup>19</sup> which is represented as an improvement on the German material on account of its very fine particle size, enabling spatulation on a slab with the minimum of monomer,

<sup>15</sup> Salisbury, G. B.—Application of methyl methacrylate to the tooth cured at mouth temperature. D.Dig. 49:14-7, 1943.

<sup>16</sup> Salisbury, G. B.—Direct acrylics in restorative dentistry. D.Dig. 53:484-7, 1947.

<sup>17</sup> Glen, J. H.—Fileryl: An acrylic resin for immediate insertion. D.Gaz. 11:349-52, 1945.

<sup>18</sup> Blumenthal, C. M.—Recent German developments in the field of dental resins. F.I.A.T. Report No. 1185, 27th May, 1947.

<sup>19</sup> Leader, S. A.—Direct acrylic fillings. B.D.J. 84:214-5, 1948.

and in addition on account of the use of a silicone lubricant as part of the standard technique. This lubricant is heat resistant and is claimed to impart greater hardness to the polished surface of the resulting restoration.

**PHOTO-ACTIVATION:** An alternative technique for polymerisation in the mouth was developed in England<sup>20</sup> using a photo-activator such as benzoin which greatly accelerates the polymerising action of ultraviolet light.

**SELF-CURING RESINS:** A further development is represented in the self-curing resins dealt with under the heading of relining and repairing materials. Here, apparently, no heat stimulus is required at all, merely a vigorous mixing in a jar up to about half a minute, standing while covered for about 2 to 4 minutes and then kneading for a short time. One point that must be watched in their use for restoration work is the danger of burning and damage due to the heat developed. Adequate lining of vital teeth must be provided.

The cavities are repaired in a similar way as for silicate restorations and pressure is necessary to ensure a compact filling. The fillings are claimed to set in about ten minutes at body temperature after which they may be polished.

**PRESENT POSITION:** Work is on hand on the hardness and on the peripheral penetration of fluids with such fillings for more data are essential for the judgment of these materials. For example, a note under this heading published by the American Dental Association Council on Dental Research early this year<sup>21</sup>:

"There are appearing on the retail market resinous filling materials that can be introduced into a cavity in the soft plastic state and are said to polymerise or harden in the cavity within ten minutes. From the advertising matter that has been brought to the attention of the Council on Dental Research and from correspondence with some manufacturers of these materials, it appears evident that laboratory and clinical data sufficient to justify their use have not been made public. Therefore, the Council on Dental Research recommends that any use of these direct resinous filling materials by dentists should be on a strictly experimental basis until such time as the effect of these materials and the health of the pulp tissue is established by means of adequate histologic investigations."

#### Standard Specifications.

**CERTIFICATION:** Finally, we come to the second main feature of this paper—that of standardisation. A most effective standardisation and certification scheme for twelve dental materials is operated by the American Dental Association through its Research Commission at the National Bureau of Standards, and it is hoped to introduce soon some such scheme in this country, making due allowance, of course, for the fact that conditions here are different in many respects. For example, a considerable proportion of our products is still imported and provision will have to be made to include these materials in any scheme for certification by the manufacturers or distributors. The Australian Dental Association has already taken steps in this direction and preliminary details of a certification scheme have been announced.

<sup>20</sup> Anon. (Notes and Comments)—German developments in acrylics. B.D.J. 84:128-9, 1948.

<sup>21</sup> A.D.A. Council on Dental Research—More data necessary for judgment of resinous filling materials. J.A.D.A. 38:149, 1949.



**STANDARDS:** A certification scheme cannot operate without recognised standards or standard specifications. Except for some provisional ones which were never promulgated no Australian standards exist. The preparation of these is therefore the first step. Following separate representation by the Australian Dental Association and the Commonwealth Department of Health, the Standards Association of Australia has set up a Dental Materials Sectional Committee. More details concerning standardisation have been published in another paper<sup>22</sup>.

**ACRYLIC RESIN SPECIFICATION:** Reverting to the present topic of acrylic resins, specifications for acrylic resins have not yet been considered by the Standards Committee in Australia but eventually will be. The A.D.A. Specification No. 12 is a well recognised one and it covers "Denture base material, acrylic resin, or mixture of acrylic and other resins"<sup>23</sup>. It will no doubt serve as a foundation for any specification developed here. The tests set out in this specification will be briefly considered without going into great detail into the somewhat complex testing precautions necessary to ensure that results are fair and reproducible.

**GENERAL REQUIREMENTS:** First, there are the general clauses describing the scope of the specification and the types: powder and liquid, plastic cake, or powder; pink or clear. There are general clauses on toxicity, irritation, the presence of impurities, the working qualities and compatibility with uncured denture base material. Conditions regarding translucency and colour are also laid down. All tests are carried out on the cured resin except one which is a packing test to measure the plasticity of the resin and its ability to conform to the denture mould without excessive pressure. The method used is simply to place a given weight of sample of the mixed dough on a brass block containing small holes (0.75 mm. and 1.00 mm. in diameter) and applying a 5000 gm. load at a temperature of 65°C. for ten minutes, unless otherwise specified by the manufacturer. This causes the resin to intrude into the holes and a material that will pack satisfactorily will pass into the smaller holes to a depth of  $\frac{1}{2}$  mm. or more.

The following tests apply to the cured resin.

**TRANSVERSE TEST:** The transverse test is a measure of the flexibility and strength of the material. In this test it is important to specify the time factor in the application of the load for this is essential in dealing with plastics. The selection of the transverse test was caused by the desire to make the test conditions approximate service conditions as nearly as practicable; it is more nearly representative than either a tensile or compressive test. Tests are carried out at 37°C. after the specimens have been stored in water. Useful information can be obtained of the flexibility and other properties of the material by plotting the deflection of the test bar under various loads.

**SORPTION AND SOLUBILITY:** The sorption tests are carried out on thin discs 5 cm. in diameter and 1 mm. thick. They are stored for 24 hours at 25°C., although we use 37°C., and the increase in weight should not exceed more than

<sup>22</sup> Docking, A. R.—Why dental standards? D.J.A. 21:459, 1949.

<sup>23</sup> A.D.A. Research Commission—Revised American Dental Association specification, No. 12, for denture base material, acrylic resin or mixtures of acrylic and other resins. J.A.D.A. 29:127-30, 1942.



0.7 mg. per sq. cm. of the surface. The loss of soluble material from the same specimen should be not more than 0.07 mg. per sq. cm. of surface. This figure is obtained by reconditioning the specimens back to constant weight in an oven precisely as was done prior to the tests.

**COLOUR STABILITY:** For colour stability flat specimens of the cured resin are exposed to the radiation of a sunlamp of specified characteristics. After 24 hours' exposure they should show not more than a slight change in colour when compared with the original specimens.

**ACRYLIC TEETH:** As for the other types of acrylic material, omitting for the present the liners, repair materials, and direct restorations, which have yet to be firmly established clinically, there remains the acrylic teeth. The tests carried out at the Bureau include hardness by the Knoop indenter before and after curing the teeth in contact with acrylic resin. The teeth are also examined for internal stresses by immersion for a short time in acetone. It is felt that some kind of abrasion on test is also necessary on the teeth, and experiments are under way in this direction.

**FUTURE DEVELOPMENTS:** As new resins and new applications appear, suitable tests will be devised accordingly, the clinical conditions being duplicated as closely as possible in the laboratory, although it is often extremely difficult to devise a reliable objective test to duplicate in the laboratory what the dentist finds in his surgery. However, with the advance of scientific test methods, new avenues are continually being provided and the leeway between subjective and objective tests is being continually reduced. The final word on any dental product, of course, is given as the result of clinical tests.

**CO-OPERATING PRACTITIONERS:** In this connection reference should be made to the Panels of Co-operating Practitioners which have been set up in each State of the Commonwealth in conjunction with the Dental Association's Standards Committee. These Panels provide a valuable link between the laboratory and the profession and will materially assist in the devising and selection of suitable test methods for present and future dental products. We at the Commonwealth Bureau of Dental Standards should be glad to hear of comments on new materials, or even old ones, at any time either direct or through the Standards Liaison Officer of your Branch, and we are ready to assist, as far as we are able, any member of the profession in technical problems associated with the properties of the materials he uses.

## EFFECTS OF LOSS OF VERTICAL DIMENSIONS IN EDENTULOUS PATIENTS\*

C. H. GRAHAM, D.D.S., F. TREBITSCH, B.D.S., A. G. ROWELL, D.D.S.

**Dr. Graham.** In September, 1946, there appeared in the Medical Journal of Australia, an article on Costen's Syndrome by J. C. Bell, stressing the far-reaching and injurious effects of dentures that permitted an overclosure of the mandible. Subsequent to the publication of that article great interest in the condition was shown by the medical profession, so that many patients suffering from obscure head pains were referred to their dentists for investigation of their oral vertical dimensions, especially when the patients were edentulous or partially edentulous.

Unfortunately in many cases the treatment provided has proved of little benefit to the patient but in other cases clear signs of improvement have been noticed. There is no general treatment-plan to cover the wide variety of symptoms associated with Costen's Syndrome, so this discussion has been designed to review the present knowledge of the effects of reduced vertical dimension and, if possible, to suggest a plan of treatment. To be able to discuss the various manifestations of reduced vertical dimension, it is necessary to define vertical dimension itself: it may be stated that vertical dimension is the distance between the alveolar ridges for any given position of the mandible. However, the correct vertical dimension exists in an edentulous patient only when the mandible is in a position analogous to that it formerly assumed with the natural teeth held lightly in centric contact, assuming that a normal free-way space had existed.

The problem then is how to re-establish this position of the jaw when the natural teeth are no longer present. It is recognised however that one position of the jaw remains unchanged, whether teeth are present or not, and that is the rest position.

The difference between the positions of the mandible in centric contact and at rest is of small degree (approximately 2mm) and is known as the free-way space. This knowledge provides a method for determining the correct vertical dimension in the edentulous patient. Measurements may be made using facial landmarks, such as the base of the nose and the point of the chin, to ascertain the rest position, and so arrive at an accurate determination of the correct vertical dimension. With the continual process of resorption of the alveolar ridges, the inter-ridge distance is gradually increased which, if not compensated by periodic adjustment of the dentures, will permit the mandible to assume a position closer to the maxilla when in occlusion so that a condition of reduced vertical dimension will then exist.

This overclosure of the mandible may be evidenced by changes in the facial, intra-oral and condylar regions. In the facial changes that occur, shortening of the lower  $\frac{1}{3}$  of the face is evident with a sharpened-chin effect, loss of lip-fullness, puckering of lips, creasing of the corners of the mouth and flabbiness of the cheeks. Intra-orally there may be a decrease in the space for the tongue, as the mandible now occupies a position closer to the maxilla. Restriction of the tongue-movement and placement have been thought to cause backward dis-

\*These papers were read before a meeting of the Discussion Group of the Institute of Dental Research, held at the United Dental Hospital, Sydney, August 18, 1948, Chairman, N. E. Goldsworthy.

placement of the tongue, with possible occlusion of the Eustachian tubes and interference with the function of hearing. Also the muscles of mastication cannot operate to their fullest advantage, so that the patient's masticatory efficiency is impaired.

The above-mentioned changes are common results of the altered position of the mandible and may be the patient's only symptoms and signs.

Sometimes a decrease in vertical dimension is purposely affected to reduce the masticatory force from a patient's dentures, as for example when the underlying ridges are of unsatisfactory dimensions or lack satisfactory tissue-coverage. On such occasions it is most important to provide a balanced occlusion. If the decrease in vertical dimension is brought about by lack of compensation for the resorptive process, then the change of position of the mandible will reduce tooth-contact areas and cause cuspal interference in function leading to rocking or even displacement of the dentures.

If the patient is young or, if older, of good general health, such unsatisfactory conditions may well be tolerated without any detrimental effect. However, in less fortunate individuals degenerative changes may arise in the condylar region. With loss of support from the teeth much of the masticatory stress is transferred onto the temporo-mandibular joint. This stress becomes evident to the patient by soreness of the joint, onset or increase of deafness and occipital pain—all general symptoms of Costen's Syndrome.

The soreness of the joint may possibly be due to direct inflammation and initiation of an arthritis. The deafness is a symptom frequently found but sometimes difficult to explain. It is possible that the general disturbance in the joint may indirectly interfere with the intra tympanic pressure. The cause of pains in the temporal and occipital region is also difficult to trace. However, the auriculo-temporal nerve is in close proximity to the head of the condyle and irritation to this nerve would explain pain in the temporal region, outer ear and parotid gland. Such irritation could hardly be caused by direct interference from the head of the condyle but the general inflammatory reaction in the region might reasonably be said to affect the nerve. In a similar manner the chorda tympani may be involved; this would explain the frequently occurring symptom of a burning sensation of the tongue.

Some investigators of this problem in the past have the view that the distal movement of the head of the condyle, associated with the overclosure of the mandible, will bring the condyle into direct contact with the tympanic plate or cause it to press on the thin plate of bone in the glenoid fossa adjacent to the middle cranial fossa. These eventualities would constitute a satisfactory explanation of the many symptoms, but histological and detailed anatomical study now tend to disprove that such pressures are set up.

Briefly, then, reduced vertical dimension may be the result of either a considered therapeutic procedure or of a gradual resorption of the alveolar bone without compensation by adjustment to the dentures. In either case, but especially the second, it can be expected that masticatory pressure will be transmitted to the condylar joint in an unphysiological degree and hence give rise to the symptoms that have been discussed.

**Mr. Trebitsch.** It is my intention to say a few words on the function

of the normal and pathological temporo-mandibular articulation. Many facts, aspects and problems of great interest would have to be considered to make the discussion complete. However, in order to keep to our timetable, I shall try to cut out everything which can be dispensed with.

To begin, I invite you to a little excursion into Physics. When we examine the joint of a pair of pliers, we find that this joint allows movements in *one* plane only; we call it a joint with one degree of freedom of motion. A ball-socket joint, such as we find in the headrest of our dental chair, is capable of movements in three different planes; we call it a joint with three degrees of freedom. It is impossible to obtain more than three degrees of freedom of motion from one single joint. However, the kinematic proposition between the human skull and mandible demands four degrees of freedom of motion on both the right and the left side.

If Engineering Science were asked to solve this problem, the engineer would fit two associated joints on each side. That is exactly what has developed in the masticatory organ—an upper joint between temporal bone and disc and a lower joint between disc and condyle. The disc acts as a moveable socket for the condyle, allowing it to rotate in any degree required to effect the condylar motion of the various movements of the mandible.

One of these movements is of special interest for the study of vertical dimension: it is the opening (and closing) movement. When we place our finger on the skin above the lateral end of the condyle and open the mouth slowly, most of us will feel the condyle gliding away from beneath our finger. As we vary the distance between upper and lower jaws, the condyle occupies different positions.

The first author to publish an account of this opening movement was a Frenchman, Ferrein, in 1744. He found that the pivotal point of the movement is situated, at the beginning, in the condyle. However, as the mouth opens the condyle moves forward, the angulus going back; the pivotal point would therefore then be—as Ferrein reasoned—in the middle between the condyle and angulus at the mandibular foramen, thereby saving nerve and vessels from untoward disturbance.

This conclusion of Ferrein was wrong and his teleological conjecture does not fit the case. Nevertheless, Ferrein's explanations are still found in most of the textbooks of Anatomy and Prosthetics, in spite of the fact that the real kinematics of the opening movement have been discovered in the meantime.

This is not just a point of theory, but one of great importance for diagnosis and treatment, because the opening movement of the joint of a normal subject is different from that in a patient suffering from a reduced vertical dimension.

In fig. 1a, we see the opening movement of an edentulous jaw a short time after the loss of the dentition. Right from the commencement of the movement the condyle goes forward and downward. The pivotal point of this first phase of the opening movement has been found to be below and at the back of the condyle, in the region of the mastoid process. This point is maintained only momentarily for the first phase of the movement. But this first phase is the only phase which has special interest for the dental practitioner.

The fact that the condyle is gliding during opening and closing results in relief of the structures of the joint from excessive pressure. During the masticatory movements well constructed artificial dentures with balanced occlusion in the molar area should also render support against the strain of the masticatory force. As long as the masticatory stress is well distributed in the artificial dentition, the joint is relieved of undue strain.

In the normal, healthy individual, the mandible is not acting as a lever, but as a spatial beam on several supports. If we want an example of a spatial beam on several supports, we will find similar statical conditions in an out-rigger canoe or in a partial skeleton denture; the out-rigger or the indirect retainers would represent the condyles.

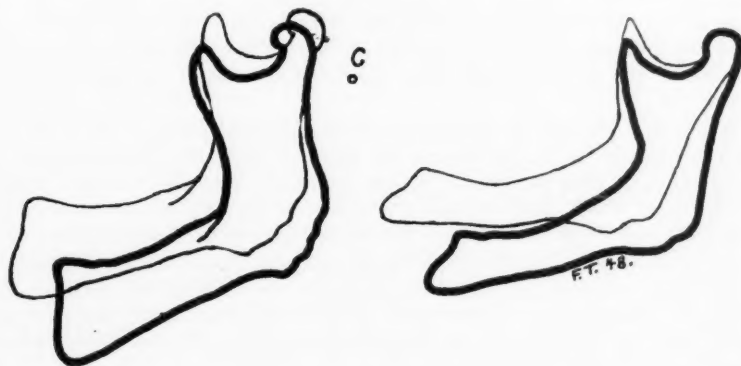


FIG. 1A

FIG. 1B

What is necessary to keep this rather complicated organ in a healthy state? Siehle has formulated three conditions for health, valid for a single cell, for an organ and for an individual. These three conditions are: (i) normal function, (ii) adequate flow of nutritive substances through the tissues and (iii) proper reflex nervous control. There is no doubt that nutrition and nervous control do play an important part in affections of the temporo-mandibular joint. However, while dealing with the subject under discussion, we are most concerned with function.

Function of the joint is fundamentally altered, when—as a result of lack of molar occlusion—the joint is no longer relieved of disproportionate strain due to the masticatory forces. Excessive strain is therefore transferred to the structures of the joint, which will—due to the trophic plasticity of bone—readily accept the new strain and by so doing undergo tissue changes.

In a state of reduced vertical dimension the condyle goes deeper into the glenoid fossa, toward the processus articularis posterior. This bony process is then an obstruction to any further retreat of the condyle, and eventually may suffer trauma.

If the reduction progresses, the condyle will be forced to rotate around its imaginary transverse axis, as seen in fig. 1b. As a result of this type of



rotation the mandible can no longer be considered a spatial beam, but becomes a third class lever with the fulcrum at the joint.

Not only excessive pressure, but—what is worse—shearing stress is now transferred to the joint: this latter is the most unfavourable kind of stress that such surfaces can experience. They become fringed and fimbriated and show villi formation, as seen in the histological evidence of W. H. Bauer.

In such circumstances the disc undergoes degenerative changes. In the initial stage it may calcify at its centre. At a later stage of progressive destruction it may become perforated or disappear altogether. The cartilage and subsequently the bone are split. Particles of various sizes are broken loose and—due to the heavy pressure—are impacted into the clefts of the underlying tissue. Reactive proliferation of blood vessels and of marrow spaces occurs; bone and cartilage appear, with callus formation around tissue-debris and fibrosis in the bone-marrow bordering the affected surfaces of the condyle and the articular tubercle. Haemorrhages and traumatic cysts can be observed.

While the destruction of tissue and the grinding of bony facets is concentrated mainly in the middle of the affected areas, the proliferations are usually found at their periphery, thereby producing irregularly shaped, bulging protuberances which may simulate extensions of the original articulating surfaces. This can be well observed on a skull I have here.

When the condyle passes more deeply into the glenoid fossa, the range of its movement becomes limited by the walls and borders of this cavity. Thus, when the patient tries to compensate, by wide excursions, for the poor masticatory effect of his bare ridges or unsatisfactory dentures, additional damage between condyle and fossa is caused.

This pathological movement of the condyle, especially during lateral excursions of the mandible, may cause the grinding-down of the entire tubercle and considerable deformity of the condyle.

A vicious circle has begun. Altered function has caused tissue changes with irregular attempts at repair. These tissue changes cause further aberration from the previously healthy function. Finally the essential features of a chronic, destructive inflammatory process, arthritis deformans, are established. In the advanced stage the salient clinical signs of this disease are:—

- (i) Reduction of vertical dimension,
- (ii) The rotation round the condyle in first phase of opening movement.
- (iii) Clicking and crepitation can be frequently heard and felt in the condylar joint.
- (iv) The muscles and the joint are stiff, and the initiation of movement is slow and difficult.

The best and only method of treatment is the aetiological concept: to endeavour to restore normal function in the joint and thus avoid the vicious circle.

**Dr. Rowell.** Dr. Graham has indicated the main sequelae of the loss of vertical dimension in edentulous patients. A readily recognisable sign of



this loss of vertical dimension is facial disharmony with apparent prognathism of the mandible. In such cases the abnormally compressed lips give a fullness to the cheeks and cause creased tissue-folds of the chin and upper lip. As a result of the lack of tone of the orbicularis oris muscle it may no longer prevent the escape of saliva from the mouth at the commissures of the lips, thus causing the development of chronic sores (angular cheilitis) in some cases.

Associated with these signs may be the symptoms of Costen's Syndrome. Such symptoms, however, may be entirely lacking in cases with gross loss of vertical dimension. On the other hand, symptoms similar to those of Costen's Syndrome may exist where careful clinical examination indicates that there has been no apparent loss in vertical dimension, so that some other possible cause for the symptoms must be found.

Mr. Trebitsch has covered the anatomical and physiological characteristics of only the temporo-mandibular joint but, had time permitted, I am sure that a survey of the whole musculature of mastication would have been included, as this is most important to the understanding of the problem.

My time is strictly limited also and therefore I consider it will be better for me to spend it in drawing attention to the need for care in the diagnosis of Costen's Syndrome rather than in too short a time to attempt to deal with all the clinical aspects of the loss of vertical dimension in edentulous patients.

Since Costen described the set of symptoms he found associated with loss of vertical dimension, it has become popular and even fashionable to regard all sorts of vague symptoms (e.g., pain) in and around the temporo-mandibular joint and along the terminal branches of the trigeminal nerve as elements of Costen's Syndrome. Many rash and damaging promises have been made to patients that by "opening the bite" a somewhat miraculous cure would automatically result.

My observations lead me to believe that:—

1. Loss of vertical dimension in wearers of full dentures is usually a slow process and the resultant damage is of a degenerative type with anatomical changes which are often difficult to correct.
2. Considerable loss of vertical dimension may occur without alarming symptoms other than a decrease in functional efficiency and even this decrease may be so slow in its onset that the average patient is unaware of it until told about it.
3. It is necessary to understand the new concept of the mode of function of the mandible and the temporo-mandibular joint to realise how symptoms of Costen's Syndrome may develop *without* loss of vertical dimension.
4. The establishment of balanced occlusion is of paramount importance.
5. The attempt to restore the correct vertical dimension is in a number of cases fraught with numerous difficulties and so I consider that thought should be given to the degree of initial restoration to be attempted *prior* to the commencement of such treatment.

There may be quite a difference between the bite of partially edentulous patients showing loss of vertical dimension and that of edentulous patients.

The difference is summed up by contrasting partially and completely edentulous patients:—

1. The prognathism may be more pronounced, as the position of the mandible in centric occlusion is governed by the malpositioned opposing teeth. This sometimes results in an actual protrusion of the condylar heads during closure in habitual centric occlusion. Such a position differs from that in edentulous patients in which loss of vertical dimension causes a backward displacement of the condyles and not a protrusion.
2. Success in the recovery of lost vertical dimension is more readily attained in partially edentulous patients, because in such there remains some anchor on which to stabilise the corrective appliance.
3. For partially edentulous patients, bite-correcting appliances of simple design may be more readily constructed in an attempt to estimate the possibilities of treatment and the loss of vertical dimension can be more accurately determined because the teeth remaining afford a means of estimating the degree of loss.



FIG. 2A



FIG. 2B

FIG. 2C

Some examples illustrated here demonstrate clearly the gross loss of vertical dimension frequently encountered. Models are shown with and without the carefully designed prosthesis and profile photographs demonstrate the degree of facial disharmony shown by the prognathic appearance when the habitual centric position is reached. (Figs. 2-4).

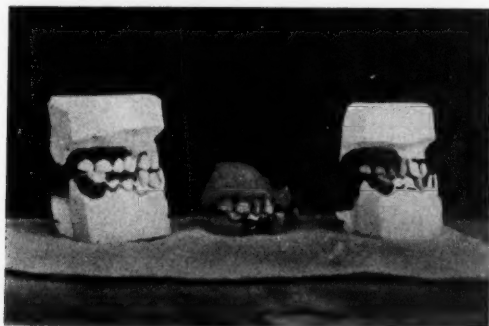


FIG. 3A



FIG. 3B



FIG. 3C

The main points which I shall stress in regard to these cases are:—

- (i) None of the patients had any of the symptoms or signs included in Costen's Syndrome.
- (ii) None considered that his bite could be improved until the fact was demonstrated.
- (iii) None realised the degree of dysfunction present until he was so advised. This was possibly due to the slowness with which the condition developed and also to the fact that "you don't miss what you haven't had."

Reverting to my original intention of discussing the care needed in establishing the existence of Costen's Syndrome, I have selected three patients whom I have examined and treated recently, and two whom Dr. Graham has treated.

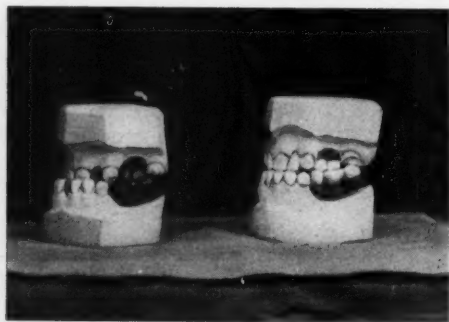


FIG. 4A



FIG. 4B



FIG. 4C

*Case A.* Female patient aged 42. On examination she stated that she had, over the last eight months experienced pain in the temporo-mandibular joint during yawning. She complained of soreness of the throat and the base of the tongue, also of a "drawing feeling on the left side of the face" and pain around the left eye. She had had earache "like that felt when an abscess is developing in the ear." She experienced shooting pains during chewing and pain in moving the tongue but only in its posterior third. The patient was wearing complete dentures and there was no apparent loss of vertical dimension: the free-way space was approximately 2mm. Examination of the ear, nose and throat disclosed no abnormality, but radiograms of the temporo-mandibular joints in open and closed positions showed a derangement of the left joint.

Close questioning linked the onset of the symptoms to a *severe* yawn which may have damaged the temporo-mandibular ligament or capsule and possibly caused a sub-luxation of the meniscus. The patient responded well to the treatment which was to rest the joint by the application of 4-tail bandage, the dentures themselves acting as a splint. No opening of the vertical dimension was attempted.

*Case B.* Female patient aged 38. She complained of inability to open her mouth widely and had consulted her physician for treatment of earache in left ear, which had lasted intermittently for five months. A check of the ear, nose and throat revealed no abnormality. Coughing or yawning initiated intense pain in the left temporo-mandibular joint. The patient was partially edentulous and had malocclusion but no detectable loss of vertical dimension: the free-way space was approximately 2mm.

Her condition was determined to be an aftermath of a severe attack of influenza. The patient had a history of arthritis. The condition was diagnosed finally as temporo-mandibular arthritis. Improvement has been rapid under conditions of rest attained by the use of an acrylic splint (Gunning type).

*Case C.* Male patient, aged 58, who has been partially edentulous since 1912. The only occlusal contact since that date was between the upper and lower central incisors in centric occlusion. About five years ago the patient began to experience attacks of dizziness which increased in frequency and severity. Twelve months after the onset of the symptoms attacks of nausea, vomiting and purging lasting from one to three hours accompanied the dizziness. Deafness in the left ear followed. It was noticed that a sharp turn of the head to the left would bring on these symptoms. Examination of the ear, nose and throat revealed that hypertrophic tonsillar tissue was occluding the left internal auditory tube. The subsequent surgical removal of this tissue resulted in complete recovery from all symptoms except the partial deafness in the left ear, which although much improved, persists as a partial tonal deafness.

Dentures for this patient have been constructed purely for masticatory and aesthetic reasons. I believe that no alteration of the bite would have produced the results obtained by the surgical treatment. Although this patient had most severe symptoms of Costen's Syndrome he was cured without any alteration to the bite, which continued to be excessively closed even after the disappearance of the symptoms.

The two cases which Dr. Graham cited are as follows:—

*Case D.* A male patient aged 48 had all the common symptoms of Costen's Syndrome. He was wearing complete dentures without detectable loss of vertical dimension. However new dentures were made for him: this time with the same vertical dimension as before but with balanced occlusion. Wearing these the patient gradually recovered completely over a period of six months.

*Case E.* A female patient aged 40 experienced a burning sensation in the tongue and occipital pain. She complained also of pain in both temporo-mandibular joints. A tentative diagnosis of Costen's Syndrome was made. New

dentures with balanced occlusion were constructed for her. Subsequently the symptoms disappeared for approximately six months but after that time they returned. A medical examination indicated that the patient was suffering from anaemia and for this she is still under treatment.

In regard to the partial deafness which is stated to be a symptom of the condition, I can recall only one patient whom I have treated in whom an obvious and continued improvement of hearing occurred. This patient requested full dentures to replace the ones which she had proudly worn for 20 years. There was gross alveolar resorption and loss of vertical dimension. I re-established what I considered to be her correct vertical dimension. Six months later she made the unsolicited statement that her hearing had improved following the insertion of the dentures and asked whether the new dentures had anything to do with it. That was in 1938 and then I became interested in what might be done towards the recovery of a gross loss of vertical dimension; but the intervention of the War deferred my study of this problem until 1945 when the patients whose models you see displayed here were treated.

In conclusion I would make the following observations:

1. The onset of loss of vertical dimension in complete-denture wearers is insidious and its progress slow. As the mandible approaches closer to the maxilla over a period of time muscle imbalance develops. The functional length of the internal pterygoid muscles is decreased owing to their reduced working-range which causes muscular inefficiency and partial atrophy. At the same time the external pterygoid muscles are hypertonically stretched by the backward movement of the condyles in their respective fossae. Over a period of time this may cause a forward inclination of the neck of the condyle and, because of the attachment of the external pterygoid muscles to the capsule and the meniscus, may draw the meniscus in extreme cases so far forward as to cause its dislocation. This has been observed by N. L. Harris and other investigators.

It must be obvious that, once this condition is established, its overnight cure is only a pipe-dream. I therefore make this point: it is dangerous to promise a patient that by 'opening the bite' some miraculous cure will automatically result, and this applies particularly in relation to the cure of the symptom of partial deafness.

2. Be sure to exclude traumatic, infective and rheumatic types of temporomandibular arthritis before diagnosing a case as Costen's Syndrome.

3. With elderly patients, only in specially selected cases should complete recovery of the normal vertical dimension be attempted immediately, as in most cases the patient's muscles will not adjust themselves to the new circumstances. The desirability of recovering the lost vertical dimension in successive stages should be considered in these cases.

4. Never open the bite so much that the free-way space is eliminated, as this would cause excessive alveolar resorption until the free-way space is re-established.

5. Determine the degree of recovery of the lost vertical dimension by considering—



- (a) the age of the patient,
- (b) the size and condition of the ridges,
- (c) the size of the denture-space,
- (d) the mental attitude of the patient to a marked change in the bite and facial contour.

6. Most important of all is the old adage that "prevention is better than cure." Never dismiss a patient after the insertion of new dentures without impressing on him that no dentures are "permanent" because of the ever changing condition of the tissues underlying the dentures. Impress indelibly on the patient's mind the need for returning for regular routine examinations of the bite, no matter how comfortable the bases appear to be. Demonstration of models and photographs of patients who have failed to do so will help in this matter.

7. Finally, try to understand the new concept of the mode of action of the mandible, as propounded by Robinson of Southern California. It will then be clear how by failure to replace lost posterior teeth with a satisfactory fitting denture and maintain it in a well balanced state, a condition can result in which the menisci actually become the fulcra for abnormal temporo-mandibular pressure. This abnormal pressure can bring about the symptoms of Costen's Syndrome without any detectable loss in the vertical dimension.

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## LABORATORY METHODS FOR ASSESSING SUSCEPTIBILITY TO DENTAL CARIES\*

### PART II. CORRELATION OF RESULTS OBTAINED BY CLINICAL EXAMINATION AND BY STANDARDISED LABORATORY METHODS

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#### INTRODUCTION.

In Part 1 of this paper a report is given of an investigation into three laboratory tests (each claimed to give an accurate indication of caries activity) and of the suggested standardisation of the techniques used in these tests. They are the lactobacillus count (Hadley), the buffer capacity test (Dreizen, Mann, Cline and Spies), and the chemical test involving enamel dissolution by a saliva-glucose mixture (Fosdick, Hansen and Epple). Another test for caries-activity was also suggested on the basis of observations that the hydrogen ion concentration after incubation of the enamel-glucose-saliva mixture gave good correlation with the increase in calcium in solution as determined by the chemical test.

In order to evaluate the relative merits of this new test and of the other standardised (see Part 1) tests under local conditions, it was decided to investigate all four tests with a view to ascertaining what correlation exists between the assessment of susceptibility to caries by laboratory methods on the one hand and by clinical and radiographical examination on the other hand.

#### METHODS AND MATERIAL.

The standardised procedure, as set out in Part 1, was adhered to throughout the investigation. Eighty-six individuals, susceptible in various degrees to caries, were selected and their caries-activity assessed independently by the four laboratory tests and by clinical means. The individuals selected were aged from six to twenty-four years, the average age being 14.9 years. This age-group was deliberately chosen so as to ensure that the caries was moderately recent. Each test was carried out from 1-12 times on each individual, the average being 3 times.

In order to ascertain the accuracy of the activity tests it was found convenient to divide the individuals tested into five groups according to the "clinical" activity of the disease. Purely arbitrary divisions were made depending on the number of D.M.F. teeth of the individual. It was felt that this was not an altogether satisfactory means of assessing caries-activity clinically, but unfortunately it was not possible to keep the people under observation for the two-year period necessary to observe rate, or change in rate, of progress of the disease.

Arbitrary standards were defined for the four activity tests. In order to determine these standards spot diagrams were made by charting the results of each test separately against the clinical condition: the standards that gave the best correlation were then selected. The standards selected are shown in Figs. 1-4 and in Tables II-V.

\* Portion of this work was carried out with the aid of a grant from the National Health and Medical Research Council of Australia.

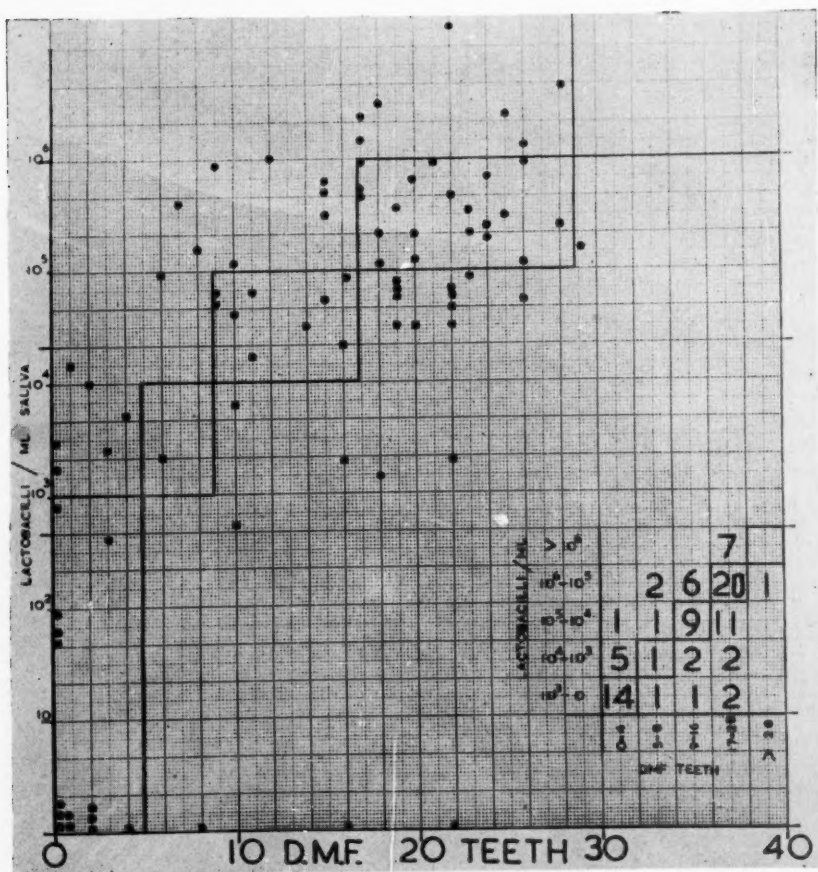


Fig. 1.—Chart of the clinical examination of individuals and their lactobacillus count.

TABLE II.

Correlation of arbitrary subdivisions of values obtained by the clinical examination and the lactobacillus count.

'score'	Clinical assessment of D.M.F. teeth.	Lactobacillus count /ml saliva.
±	0 - 4	0 - 1,000
+	5 - 8	1,001 - 10,000
++	9 - 16	10,001 - 100,000
+++	17 - 28	100,001 - 1,000,000
++++	> 28	> 1,000,000

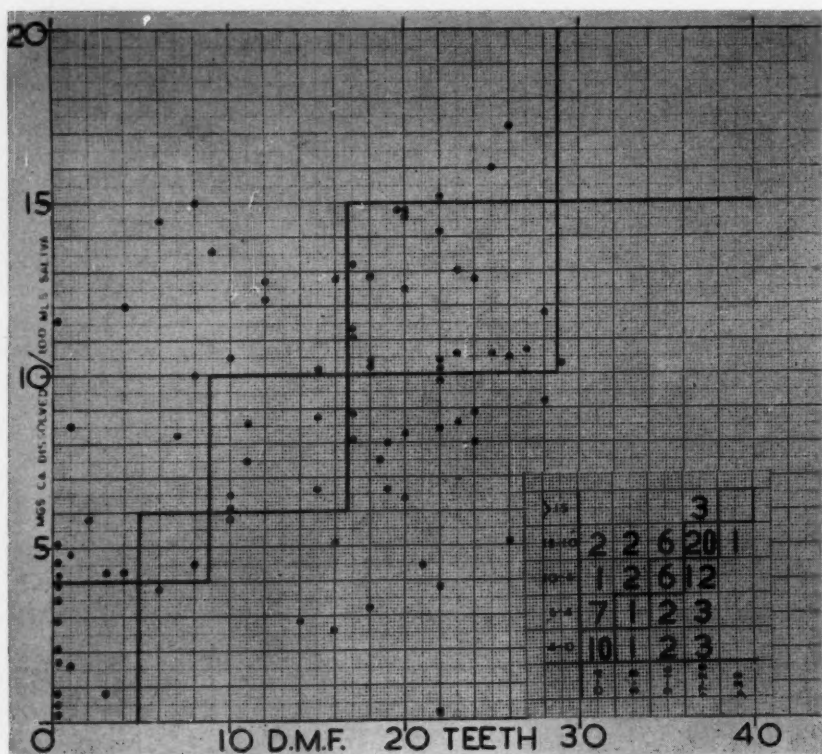


Fig. 2.—Chart of the clinical examination of individuals and the chemical test of their saliva.

TABLE III  
Correlation of arbitrary subdivisions of values obtained by the clinical examination and the chemical test.

'score'	Clinical assessment of D.M.F. teeth.	Chemical test: increase in salivary calcium mg/100ml saliva.
±	0 - 4	0 - 4.00
+	5 - 8	4.01 - 6.00
++	9 - 16	6.01 - 10.00
+++	17 - 28	10.01 - 15.00
++++	> 28	> 15.00

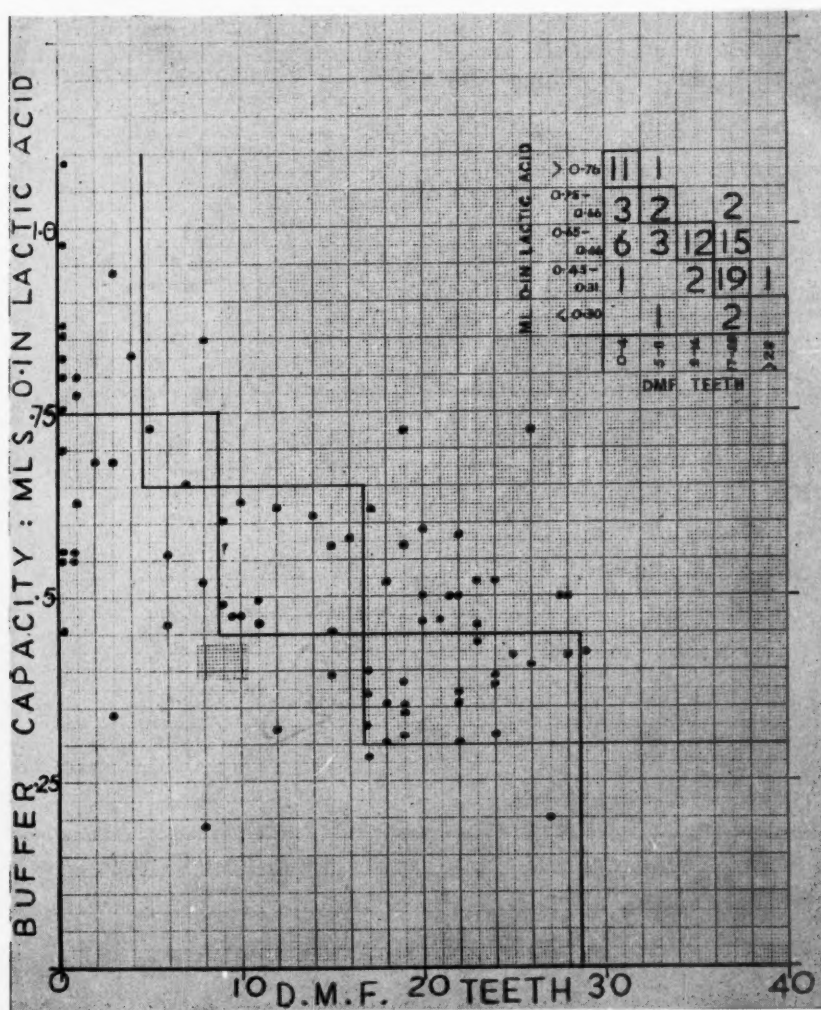


Fig. 3.—Chart of the clinical examination of individuals and the pH value of their saliva after incubation.

TABLE IV.  
Correlation of arbitrary subdivisions of values obtained by the clinical examination and pH value after incubation.

'score'	Clinical assessment of D.M.F. teeth.	pH after incubation for chemical test.
++	0 - 4	> 5.61
+++	5 - 8	5.60 - 5.31
++++	9 - 16	5.30 - 5.11
+++++	17 - 28	5.10 - 4.81
++++++	> 28	< 4.80

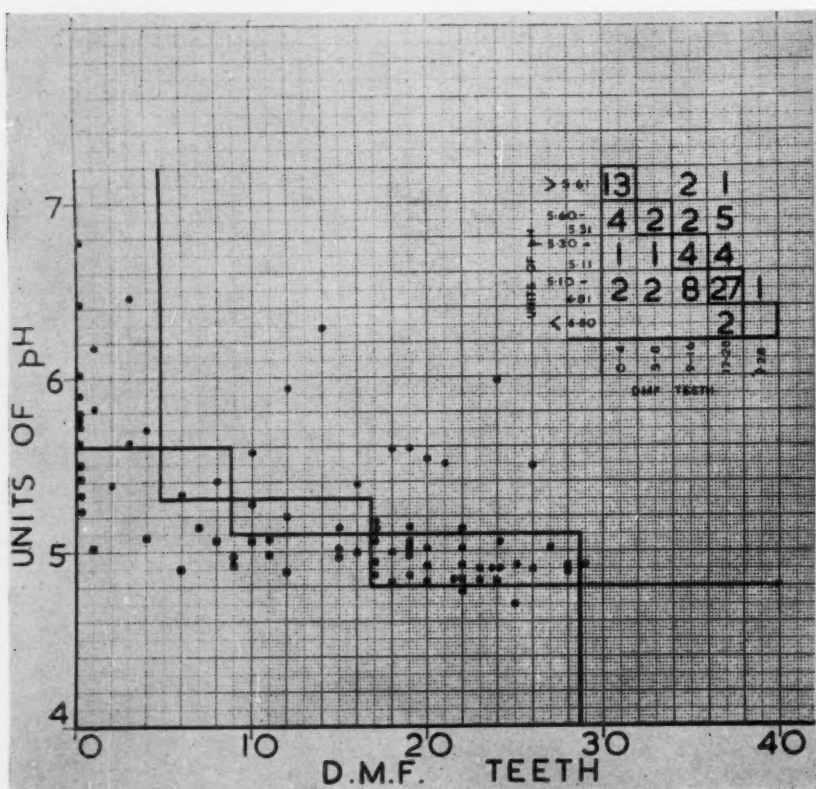


Fig. 4.—Chart of the clinical examination of individuals and the buffer capacity of their saliva.

TABLE V.  
Correlation of arbitrary subdivisions of values obtained by the clinical examination and buffer capacity.

'score'	Clinical assessment of D.M.F. teeth.	Buffer Capacity*.
±	0 - 4	> 0.76
++	5 - 8	0.75 - 0.66
+++	9 - 16	0.65 - 0.46
++++	17 - 28	0.45 - 0.31
+++++	> 28	< 0.30

\*Number of ml of 0.1N lactic acid required to lower pH from 7.0 to 6.0.



The selection of these arbitrary standards given for the hydrogen ion concentration (Table IV, Fig. 3) after incubation of the glucose-enamel-saliva mixtures may seem strange in view of the claim that the crucial point for the dissolution of enamel is pH 5.0<sup>24</sup> under *in vitro* conditions. Nevertheless a hydrogen ion concentration represented by a pH value of more than 5.61 is the standard selected for the first group in whom the chemical test showed an increase of 0.4mg calcium in the mixture. Schmidt Nielson<sup>51</sup> in 1946 reported that the hydrogen ion concentration at which salivas became unsaturated with calcium phosphate varies from pH 5.2-5.85 (salivas with low calcium and phosphorus content at pH 5.85 and those with high calcium and phosphorus content at 5.2). The results of the hydrogen ion concentration test reported here seem to support Schmidt Nielson's work.

The degree of correlation of the results of each laboratory test with the clinical 'score' varied with each test. Agreement was considered 'complete', if the results fell in the same group of arbitrary classification; for example, if caries-activity was assessed by clinical means as ++ and by the lactobacillus count as ++. Agreement was considered 'moderate', if the grouping was such that it showed the trend of activity but not precisely the same degree of activity; for instance, when a 'score' of ++ was obtained by clinical means but one of +++ or + by laboratory test. Other grades of discrepancy were considered as 'poor', as for example when the 'score' by clinical means was ++ and ++++ or ± by a laboratory test.

#### RESULTS AND DISCUSSION.

The correlation of the clinical recording of the present caries-activity and the results of the various laboratory tests is set out in Table VI.

TABLE VI.  
Correlation of clinical conditions and results of laboratory tests.

Type of Test.	Complete agreement.			Moderate agreement.						Poor agreement**.		
	No. Tests.	No. Sub-jects.	% Sub-jects.	Laboratory tests indicated.						No. Tests.	No. Sub-jects.	% Sub-jects.
				more activity.			less activity.					
				No. Tests.	No. Sub-jects.	% Sub-jects.	No. Tests.	No. Sub-jects.	% Sub-jects.			
Lactobacillus count	139	44	51	45	19	23	49	15	17	15	8	9
Chemical test ...	113	37	45	67	18	21	49	16	19	28	13	15
pH after incubation	141	46	58	50	15	18	20	7	9	30	13	15
Buffer capacity ...	124	44	54	37	10	12	53	17	22	28	10	12
			—			—			—			—
			—			—			—			—
			—			—			—			—

\*\* Further investigation of cases of 'poor' agreement seemed to indicate that the discrepancies were due to errors in clinical assessment. Of the 17 subjects involved in these analyses, 10 seemed to need regrouping when the condition of the mouth and the previous 4-year history were considered in detail and not merely the number of D.M.F. teeth. This is discussed more fully when the individual results are assessed.

It seems from these results that the bacteriological test gives slightly closer agreement with 'clinical' caries-activity than do the other three tests: substantial agreement was found in 91% of the cases, as against 85-88% with the other three tests.

These three tests were in very close agreement, but, considering the cases of complete agreement only, the pH value after incubation for the chemical test gives closest correlation with the clinical state.

It may be of some value to inspect more minutely the results obtained from selected individual patients using the arbitrary standards given in Tables II-V. The numerical results of each test for each individual as shown in Table VII were averaged and a 'score' assigned.

TABLE VII.

Results of clinical condition and laboratory tests for individuals.

Sub- ject.	Clinical.	Lacto- bacillus count.	Chem- ical test.	pH after incuba- tion.	Buf- fer Capac- ity.	Sub- ject.	Clinical.	Lacto- bacillus count.	Chem- ical test.	pH after incuba- tion.	Buf- fer Capac- ity.
1	±	±	±	±	+	45	+++	±	±	±	+++
2	±	±	±	±	+	46	+++	±	±	±	+
3	±	±	+++	+	+	47	+++	±	+++	+++	+++
4	±	±	±	±	+	48	+++	±	+++	+++	+
5	±	±	±	±	±	49	+++	+++	+++	+++	+
6	±	±	±	±	±	50	+++	+++	±	±	+
7	±	±	±	±	±	51	+++	+++	+++	±	0
8	±	±	±	±	±	52	+++	+++	0	0	+++
9	±	±	±	±	±	53	+++	+++	±	±	+++
10	±	±	±	±	±	54	+++	+++	±	±	+++
11	±	±	±	±	±	55	+++	+++	±	±	+++
12	±	±	±	±	±	56	+++	+++	±	±	+++
13	±	±	±	±	±	57	+++	+++	±	±	+++
14	±	±	±	±	±	58	+++	+++	±	±	+++
15	±	±	±	±	±	59	+++	+++	±	±	+++
16	±	±	±	±	±	60	+++	+++	±	±	+++
17	±	±	±	±	±	61	+++	+++	±	±	+++
18	±	±	+++	±	±	62	+++	+++	±	±	0
19	±	±	±	±	±	63	+++	+++	±	±	0
20	±	±	±	±	±	64	+++	+++	±	±	+++
21	±	±	±	±	±	65	+++	+++	±	±	+++
22	±	+++	±	±	±	66	+++	+++	±	±	+++
23	±	+++	±	±	±	67	+++	+++	±	±	+++
24	±	+++	+++	±	±	68	+++	+++	±	±	+++
25	±	+++	+++	0	+++	69	+++	+++	±	±	+++
26	±	+++	+++	±	±	70	+++	+++	±	±	+++
27	±	+++	±	±	±	71	+++	+++	±	±	+++
28	±	±	±	±	±	72	+++	+++	±	±	+++
29	±	±	±	±	±	73	+++	+++	±	±	0
30	±	±	±	±	±	74	+++	+++	±	±	+++
31	±	±	±	±	±	75	+++	+++	±	±	+++
32	±	±	±	±	±	76	+++	+++	±	±	+++
33	±	±	±	±	±	77	+++	+++	±	±	+++
34	±	±	±	±	±	78	+++	+++	±	±	+++
35	±	±	±	±	±	79	+++	±	±	±	0
36	±	±	±	±	±	80	+++	+++	±	±	+++
37	±	±	±	±	±	81	+++	+++	±	±	0
38	±	±	±	±	±	82	+++	+++	±	±	+++
39	±	±	±	±	±	83	+++	±	±	±	±
40	±	±	±	±	±	84	+++	±	±	±	±
41	±	+++	±	±	±	85	+++	±	±	±	±
42	±	+++	±	±	±	86	+++	±	±	±	±
43	±	±	±	±	±						
44	±	±	±	±	±						

(a) Complete agreement between the clinical assessment and results of the four activity tests was obtained in 17 of the 86 subjects.

(b) In 22 individuals complete agreement was obtained in three out of four of the tests and moderate agreement in the remaining test.

(c) 17 gave complete agreement in two tests and moderate agreement in two tests.

(d) 14 subjects gave good correlation between the clinical state and one test only and fair correlation in the other three. Closer examination of the results from these fourteen individuals seemed to indicate possible explanations of some of these apparent discrepancies, which are similar to those observed by Dreizen, Mann, Cline and Spies<sup>10</sup>.

In 4 of the 14 persons the lactobacillus count was low, as was also the buffer capacity. It is suggested that, under the artificial conditions of the sealed test tube, sufficient acid is produced by the few bacteria to overpower the low buffering capacity and so to dissolve the enamel, giving a high 'score' with the pH and chemical tests. Apparently in the dynamic environment of the mouth the buffer capacity of the constantly renewed saliva is sufficiently high to overcome the small amount of acid produced and so no caries occurs.

Three other persons had a high lactobacillus count and a high buffer capacity. In the tube these bacteria were unable to overpower the buffer substances, hence the pH and chemical 'scores' are low. In the mouth of these subjects the acid-producing systems were apparently more efficient and so overcame the buffers and caries resulted.

In three subjects, three out of four tests showed less activity than the clinical state suggested. The clinical history of these three patients over the last four years showed a slowing down of the caries process.

One individual showed activity in three out of four tests, though clinically regarded as caries inactive. The remaining three individuals, who showed good correlation with the clinical in only one test gave 'scores' from + to ++++ for the different tests. The average 'score' however, was close to the clinical 'score'. No explanation for the variation in these results was apparent.

(e) Sixteen subjects showed no correlation with the clinical 'score'. Seven of these 16 showed less activity by all four laboratory tests and all 7 subjects reported that the amount of caries appears to have diminished over the past four years or more. It was felt that in these persons the laboratory test gave the more accurate assessment of the caries-activity; that the clinical method of assessing activity (by counting the D.M.F. teeth) revealed only or mainly past susceptibility.

The other 9 subjects showed by laboratory tests greater activity than was suggested by their D.M.F. 'score'. One of these had twelve unerupted teeth, another fourteen. If percentage of standing teeth affected by caries is estimated when many teeth remain unerupted, a truer index of caries-susceptibility is obtained.

Another individual in whom all four laboratory tests gave a higher 'score' (+++++) had twenty-five D.M.F. teeth and was classified as +++. However as the patient was aged 13, it was felt she was highly susceptible and clinically should be given a 'score' of +++++. In the remaining 6 of this group of 16 the laboratory tests showed a moderate degree of caries-activity, although clinically the subjects were regarded as caries-inactive. All were entering the age-group where caries-activity is greatest, and an examination in 9-12 months might reveal that dental caries is clinically obvious. Again this might be interpreted as indicating the weakness of clinical means of assessing caries-activity, because they are unable to reveal present activity-intensity until such has persisted for long enough to permit gross destruction of tooth-substance.

#### VALUE, INCLUDING PRACTICABILITY, OF THE VARIOUS TESTS.

In assessing the relative value of the various activity tests, it is necessary not only to investigate the accuracy of the results but also the advantages and

disadvantages of the individual tests as practical diagnostic procedures. For instance, from the practical point of view, the lactobacillus count has many advantages over the other tests. It can be carried out any time within three days of collection of saliva, if refrigeration is available. Conditions applicable to the collection of saliva are not as rigid as for the other tests and only simple bacteriological equipment is necessary. Also, many counts can be made within a fairly short time. On the other hand, the medium is not always entirely selective for lactobacilli.

The buffer capacity test can be quickly carried out and the only equipment needed is a burette and glass-electrode potentiometer. It must, however, be commenced within an hour of collection of the sample. Furthermore, the application of the test is limited because results are sensitive to time of day and variations in rate of salivary flow. More satisfactory results may conceivably be obtained from this test when the effect of rate of flow on buffer capacity has been intensively studied.

The chemical test has one great disadvantage in that it is expensive for routine use. Only a limited number of such tests can be carried out by one operator each day and this operator must be a chemist. Also, only freshly collected samples of saliva can be used.

The suggested fourth test, the determination of the pH after incubation of the saliva-glucose-enamel mixture for the chemical test, eliminates the main disadvantage of the chemical test. All the lengthy procedure of calcium estimation on the saliva, before and after incubation, is eliminated and the number of tests carried out in one day is a function solely of the efficiency and capacity of the mixing and incubating apparatus at the operator's disposal. Also, this operator need have no chemical training. The one limitation of this test is that only fresh saliva can be used.

A general disadvantage of all four laboratory tests, as indeed of the clinical examination too, is that a single examination is not sufficient. If satisfactory results are to be obtained the tests must be repeated at least three times. But even so, they obviate the main disadvantage of the clinical means of assessing caries-activity, in that periodic examinations over 9-12 months are not necessary. The result obtained gives an index of caries-activity at the time of examination.

#### SUMMARY.

1. A new activity test, depending on the pH attained after incubation of a glucose-enamel-saliva mixture, was investigated.
2. The correlation of results obtained by clinical means and by each of four laboratory tests is as follows:—

	Good	Fair	Good + Fair	Poor
Lactobacillus count ... ..	51	40	91	9
Chemical test .. .. .	45	40	85	15
PH after incubation for chemical test ... ..	58	27	85	15
Buffer capacity ... ..	54	34	88	12

3. Discrepancies were explained.
4. Advantages and disadvantages of the tests were discussed.

#### CONCLUSION.

All four laboratory tests were satisfactory in that each indicated the degree of caries-activity in a high percentage of subjects examined.

#### ACKNOWLEDGEMENT.

The writer wishes to express her thanks to the Director, Dr. N. E. Goldsworthy, for his interest and helpful criticism throughout this work and in the preparation of the paper.

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*The* **ADA** *JOURNAL*  
**DENTAL** *of* **AUSTRALIA**  
**EDITORIAL DEPARTMENT**

**THE ANNUAL ELECTION**

If you cast your vote at the Annual Election, 22nd November, 1949, you will no doubt read this short editorial, for you are interested in the affairs of the Association and when the next Annual Election for the Executive Committee is at hand, we suggest that you endeavour to remind at least one of your colleagues not to lose the opportunity of actively participating in the affairs of the Association.

We would remind those members who did not vote at the recent Annual Election that individual members of groups, communities, States, countries or even nations have from the earliest times striven, nay, fought bloody wars in order that their rights may be respected and maintained. Many of the rights and privileges which we possess today have been obtained after years of struggling against oppressive masters and to trace the history of our progress through many systems to our present social system would entail a life-time of work. There is one factor, however, which is fundamental.

The basic force acting either openly or otherwise has been the group; even though the inspiration may have sprung from an individual the presence of the group, large or small, is essential to success.

Success in such matters does not belong to the individual although he may be covered in honour and glory. The honour and glory may be in vain if the group has failed to support their leader, either openly or tacitly. That is why there have been many hollow victories and glorious failures throughout history.

Reforms now current could not have been successful twenty or thirty years ago. Yesteryear's radical is today's conservative. But all have been dependent upon acceptance by a majority of interested people. Expressions of support for a cause are demonstrated by allegiance to an association or society and one of the mechanisms of demonstration is through the ballot box. The ballot box, that landmark of democratic progress, the butt for the cartoonist and the source of many attacks from disgruntled contenders for popularity and other self-seekers is the individual's mechanism whereby he records his support, antagonism or antipathy towards his society.

In a small organisation, the ease with which members can utilize the blessings of the ballot box may be restricted to voting in person. However,

when every effort is made to facilitate the use of members' rights and enable them to express their opinions on the selection of their Honorary Officers and Executive Committee it is rather surprising that so few members take the opportunity at so little cost in time only to record their selection of their executive team.

It is indeed a great pity that less than one-third the total membership of the Association failed to register a vote at the Annual Election held 22nd November, 1949. One must assume, therefore, that those who did not vote were not opposed to the policy otherwise a greater number of candidates would have sought election or, alternatively, the retiring Executive would have suffered an adverse vote. As neither of these results happened, one may suppose that the members entirely endorsed the policy and administrative record of the retiring Executive. Such a manner of endorsement is hardly encouraging to any executive body, voluntarily giving considerable amounts of time to the affairs of the Association. Such a supposition may rightly be classed as presumption but of no greater order than that which supposes the bulk of the members were filled with lethargy or antipathy towards the result of the election or the affairs of their Association.

Without further discussion we must conclude on a note of warning. Such an attitude whether studied or acquired by a natural *laissez-faire* is dangerous and may result in the members of the Association losing their hard won control to an interested group.

## Correspondence

### "Anomalies of the Dentition"

Sir,

I believe that if either Mr. Griffin or Dr. Gabriel knew that their utterances would not reach print, there would be no argument.

I fail to see what interest these ultra scientific aggregations can have for the bulk of members of the A.D.A. In the main they are merely collections of the works of others—which are available to us in libraries.

If the journal contained simple articles concerning problems met with in everyday practice, it would be more widely read.

Yours faithfully,  
B. J. CHRISTY.

11th November, 1949.  
Cessnock.

### "Prevention of Rust"

Sir,

May I submit herewith as a useful hint of general interest, the following:—

"Prevention of Rusting of Instruments:—The addition of phosphoric acid (the liquid supplied with any of the oxyphosphate cements will do just as well), in the proportion of 5 or 6 drops to the gallon of the water in the sterilizer, will effectively prevent rusting of steel instruments, and check extension of existing deposits."

Yours faithfully,  
FRANK PEZET.

38 Darcy Street, Parramatta.  
October, 1949.

## **News and Notes**

### **AUSTRALIAN DENTAL ASSOCIATION STANDARDS COMMITTEE**

Australian Dental Standards for dental mercury, dental amalgam alloy and zinc phosphate cement were recently drawn up and adopted. Printed copies of these standards are now available at the office of the Standards' Association of Australia, Science House, Cnr. Essex and Gloucester Streets, Sydney. Manufacturers and importers are hereby invited to apply for the inclusion of their materials in the list of certified products to be issued to the profession by this Committee; the first list will be published shortly.

Application forms are available on request from the office of the Australian Dental Association, 147 Collins Street, Melbourne, C.1.

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### **CONGRESS**

Members desirous of submitting papers for Congress are reminded to forward their submissions as early as possible in 1950 to the respective Chairmen, care of the office of the Association.

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### **WORKERS' COMPENSATION**

In view of the fact that many practitioners are employing assistants at salaries above the rate of £750 per annum, members are reminded that the provisions of the Workers' Compensation Act necessitate insurance cover for such dental surgeons in receipt of salaries up to £1,250 per annum.

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### **14th ANNUAL CRICKET MATCH**

#### **DENTAL PROFESSION v. DENTAL UNDERGRADUATES.**

The 14th Annual Cricket Match between the Dental Profession and the Dental Undergraduates for the Jennings Shield, was held at the Woollahra Oval on Wednesday, 14th December. The large gathering included executive members of the Australian Dental Association (N.S.W.) in Dr. Everett R. Magnus, President; Mr. Norman Edney, Immediate Past President; Mr. Robert Harris, Secretary; Mr. Leslie Cooke, President Eastern Suburbs Group; Mr. Fred Thearle, President Northern Suburbs Group; Mr. W. F. Hutchinson, Treasurer Blue Mountains Division and Dr. John S. Baird, President Dental Board of N.S.W.; Dr. J. V. Hall Best, President Australian Dental Congress; Mr. Col. Croker, Superintendent Dental Hospital; Mr. E. B. Wallace, Secretary Dental Hospital.

Apologies were received from Professor Arnott, Dean of the Faculty of Dentistry; Dr. E. Stanley Wallace; Mr. Alf. Brown, President St. George Group and Mr. R. Goodwin Leeder, President Western Suburbs Group.

Several of the veteran players were present, including Dr. John Brooks, Messrs. C. Winning and L. Stewart.

The Dentists won the match with 158 runs against 130 scored by the Undergrads. Dr. J. V. Hall Best presented the Shield to the captain of the Dentists' Team (Ken Binns). Mr. Frank Hutchinson presented the trophies:—

Highest scorer for the Dentists, Ken Binns.

Highest scorer for the Undergrads, R. Taylor.

Best bowling average for the Dentists, Harry Croxon.

Best bowling average for the Undergrads, Bill Cummins.

Fielding trophy for the Dentists, Bob Norton.

Fielding trophy for the Undergrads, A. Symont.

At the luncheon, Mr. Norman Edney proposed the toast of the teams, responded to by the captains, Ken Binns (Dentists) and Bill Cummins (Undergrads). Toast of the Dental Hospital was proposed by Mr. R. Norton, responded to by Mr. Col. Croker, Superintendent and the toast of the firm of John T. Jennings Pty. Ltd., was proposed by Mr. Frank Hutchinson and suitably responded to by Mr. John T. Jennings.

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### ANNUAL CRICKET MATCH

The Annual Cricket Match, Dentists v. Doctors, will be held at the Sydney Cricket Ground on 8th February, 1950.

Members of the profession who are interested in this competition which has now been running for many years are assured of a most hospitable welcome and all are urged to attend and support their professional colleagues who will do combat with the medicos on this occasion.

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### GRADUATE

Graduate and D.D.S. Twenty years' experience, desires assistantship or partnership Macquarie Street. View to purchase.

Replies to Editor, D.J.A.

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### TO THE DENTAL PROFESSION

Owing to the acute shortage of bottles, SILVOLINE would greatly APPRECIATE the return of empty bottles, either direct to us or to your Dental House, and will pay all freight charges, plus new price, for Silvolene Amber Pomades, French Squares, 4 oz. Amber Rounds and 8 oz. Amber or Clear Jars.

Silvolene Regd.,  
56 Keira Street,  
Wollongong 5C.

## Association Activities

### AUSTRALIAN DENTAL ASSOCIATION

(NEW SOUTH WALES BRANCH)

OFFICE BEARERS, 1949-50



*Dr. E. R. MAGNUS*  
*President*



*Dr. A. G. H. LAWES*  
*Vice-President*



*Dr. F. E. HELMORE*  
*Vice-President*



*Dr. R. M. CLOUTIER*  
*Honorary Treasurer*

#### EXECUTIVE COMMITTEE:

Bastian, E. H.  
Best, J. V. Hall  
Edney, N. E.  
Finnie, H. McD.  
Grainger, W. A.  
Krauss, R.

Leeder, R. Goodwin  
Norton, R. Y.  
Reid, F. R.  
Skinner, J. W. H.  
Sullivan, H. R.  
Tompson, R.



Minutes of General Meeting of the Association held in the Lecture Hall, B.M.A. House, 135-137 Macquarie Street, Sydney, on Tuesday, 25th October, 1949, at 8.0 p.m.

*Present:* Mr. N. E. Edney, President, in the Chair, and an audience of 89 members and visitors.

*Apologies:* Dr. Rex Lane, Dr. J. V. Hall Best, and Mr. E. H. Bastian.

The President welcomed Mr. Johnston of Launceston, Tasmania, Mr. Stark of Albury, Mr. Bush of Bega, Mr. Buchanan of Katoomba, and Mr. Hutchinson of Blackheath to the meeting.

The Minutes of the Meeting held 27th September, 1949, were read and signed as a correct record.

#### BUSINESS ARISING FROM MINUTES:

*Kempsey flood relief:* The President stated that owing to the poor response to the appeal for funds to assist members who had suffered damage in the Kempsey floods—only £342/4/- had been received to date—it had been decided to extend the closing date to 11th November, 1949.

*Nominations for Executive Committee:* Members were reminded that nominations for the election of the Executive Committee for the ensuing year will close at 5.0 p.m. on Monday, 31st October, 1949.

*Scrutineers for election of Executive Committee:* The President stated that the following members had offered their services as scrutineers at the forthcoming annual election:

Dr. A. Bull and Mr. R. Dennett, Monday, 21st November, 1949, 2 p.m. Mr. W. Chesher, Mr. L. Noone, Mr. J. Gray and Mr. L. Cooke, Tuesday, 22nd November, 1949, 1 p.m., and that under the new arrangement for the earlier closing of the ballot, it would be possible to announce the result of the elections early in the evening at the Annual General Meeting.

It was resolved that these six members be appointed scrutineers for the forthcoming election of Executive Committee members.

*Lecture by Dr. F. J. McEncroe and Dr. F. E. Helmore:* The President introduced the lecturers for the evening, Dr. F. J. McEncroe who is part-time Lecturer in Radiology in the Faculty of Dentistry, University of Sydney, and Dr. F. E. Helmore.

Dr. McEncroe delivered the lecture entitled, "Radiological aids to the diagnosis of lesions of the jaws" and comments on the clinical implications were presented by Dr. Helmore, resulting in an informative presentation of a series of lesions frequently met with during routine radiological examination of the maxilla and mandible.

At the conclusion of the lecture a most informative commentary was given by Professor Arnott, who emphasised the necessity for routine laboratory examinations of all lesions revealed during X-ray examinations.

Doctors Freeman, Clarke, and Magnus and Mr. Gurney also took part in the discussion and a vote of thanks to the lecturers was formally moved by Mr. David Cameron and carried with acclamation.

The meeting terminated at 10.30 p.m.

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Minutes of Extraordinary General Meeting of the Association held in the Lecture Hall, B.M.A. House, 135-137 Macquarie Street, Sydney, on Tuesday, 22nd November, 1949, at 7.45 p.m.

*Present:* Mr. N. E. Edney, President, in the Chair and an audience of 35 members.

*Alteration to Articles of Association:* In opening the meeting the Chairman explained that the Executive Committee had recommended the suggested alteration to the Articles of Association in order that new graduates who might otherwise have been precluded from becoming members of the Association, would be encouraged to join immediately upon graduation.

The suggested resolution, a copy of which had been forwarded to all members, was then read by the Secretary, and the Chairman asked that consideration be given to the passing of this as a special resolution.

It was resolved that Article 11 shall be amended by adding at the end thereof the following words:—

Further notwithstanding the foregoing provisions any dentist registered in New South Wales who becomes a member of the Association within two years after he has graduated in dentistry in any University in Australia shall be liable to pay for his first subscription only half the subscription for the time being in force under the provisions hereinbefore contained. If he is elected in the first half of any calendar year he may if he so elects pay a moiety of his first annual subscription plus an additional ten shillings and sixpence (10/6) immediately after his election and the other moiety plus an additional ten shillings and sixpence (10/6) on the first day of July following. If he is elected in the second half of any calendar year he shall pay his first subscription for the remainder of that year immediately on his election. For all calendar years after the first he shall during his membership pay the full subscriptions for the time being in force for members other than restricted and honorary members in accordance with the provisions hereinbefore contained.

Moved: Dr. Cloutier; seconded: Mr. Norton; carried *nem. diss.*

The Chairman declared the resolution passed as a special resolution.

## NEW SOUTH WALES BRANCH

### EXECUTIVE COMMITTEE.

Extracts from the Minutes of Meeting of Executive Committee held in the Council Room, B.M.A. House, 135-137 Macquarie Street, Sydney, on Monday, 14th November, 1949, at 7.30 p.m.

*Present:* Mr. N. E. Edney, President, in the Chair; Dr. E. R. Magnus, Vice-President; Dr. A. G. H. Lawes, Vice-President; Dr. R. M. Cloutier, Honorary Treasurer; Mr. H. M. Finnie, Dr. F. E. Helmore, Mr. R. G. Leeder, Mr. R. Y. Norton, Mr. F. R. Reid, Mr. J. W. Skinner, Mr. H. R. Sullivan, Mr. Ralph Tompson, Dr. A. G. Rowell, Western Division, Mr. L. Mackenzie, Blue Mountains Division.

*Apologies:* Dr. J. V. Hall Best, Mr. E. B. Green, Mr. R. Krauss, Mr. S. H. Neal, North Eastern Division, Dr. J. Thomas, Newcastle and Hunter River District Division.

In this connection a letter from Mr. Green conveying his apology and best wishes to fellow members of the Executive was read.

*In attendance:* Mr. Robert Harris, Secretary.

*Frank Marshall Prize:* Letter dated 20th October, 1949, from the Registrar of the University of Sydney conveying the appreciation of the Senate in regard to the proposal for the establishment of the Frank Marshall Prize and intimating that the Faculty of Dentistry had been asked to report concerning the proposed conditions of the award of the prize, was read and received.

*Annie Praed Oration:* Mr. Sullivan reported that the Committee appointed to investigate this matter had given consideration again to their suggestions relative to the establishment of an Annie Praed Oration in view of the reference back by the Executive and that they considered that the name Annie Praed typified high ideals in dentistry and that there were precedents for using a name such as this. Considerable discussion then ensued on this point.

It was resolved that the recommendations relative to an Oration set out on pages one and two of the Minutes of the Meeting of the Executive Committee held 10th October, 1949, be adopted and that the name be not changed from the Annie Praed Oration.

*Kempsey Appeal Result:* The President stated that the result of the Kempsey Flood Appeal was as follows:—

Donations from members and Groups .....	£432 19 6
Donation from North Eastern Division .....	37 17 0
	<hr/>
	£470 16 6

*Conference with Senator McKenna:* The Secretary reported that following the last Executive meeting a telegram had been sent to the Federal President enquiring the nature of the matter to be discussed at the conference with the Minister for Health and Dr. Wilkinson had replied that it was to be a resumption of earlier discussions relative to personnel in the light of the Hartley Gibson and Working Party's Report. The Working Party's Report had not been re-

ceived until after the Executive meeting. In view of the extensive and complicated nature of the Working Party's Report a further telegram was sent requesting that the Federal President ask the State Branches not to make any irrevocable decision at the conference with the Minister for Health. It was subsequently learnt that this telegram had not been sent and therefore all States had been communicated with directly through this office. However, in the interim, Victoria had intimated that it would support the motion seeking a postponement of the conference. Hence after consultation with the Honorary Officers a telegram was despatched to the Federal Office demanding that the Conference be postponed. This was subsequently supported by four other States and the Federal President had no other alternative but to seek postponement of the conference. At the Annual Meeting it was decided that copies of the Working Party's Report should be submitted to all State Branches for their consideration and the return of their comments to the Federal Office before the end of December, 1949, in order that a Special meeting of the Association could be held in Melbourne to consider the final attitude towards the Working Party's Report.

It was resolved that a special meeting of the incoming Executive be called as early as possible in the month of December to consider the preparation of a report on the Working Party's findings to be transmitted to the Federal Office for distribution to all State Branches.

*Facilities for Students:* Consideration was given to the resolution drafted by the Association's Solicitor, Mr. Utz, and the following recommendation from the Library Committee was read and approved:—

That the present status held by students be retained in regard to the use of the Hardwick Memorial Library but that the Fourth Year Students who participate in the benefits on the payment of £1/1/- per annum be given the right of direct borrowing with the maximum period of each borrowing of one book for one week.

It was resolved that undergraduates of the University of Sydney whilst doing their final year in Dentistry shall for a fee of £1/1/- payable in advance have the following rights:

- (1) To receive a copy of the Dental Journal of Australia as and when it is published.
- (2) To receive notices of Ordinary General Meetings and to attend thereat.
- (3) To attend at the Association's Library at such times and on such conditions as from time to time may be prescribed by the Library Committee,

provided that if for any cause any undergraduate referred to above has to repeat his final year he shall be entitled to the abovementioned rights during a year of repetition only if he pays a fee of £1/1/- in advance for each year of repetition.

*Honorary Membership for 1950:* The list of the present Honorary Members of the Association was read to the meeting.

It was resolved, (1) that the following be recommended to the General

Meeting for re-appointment as Honorary Members in 1950: The President, Australian Dental Association; The President, British Dental Association; The President, American Dental Association; The President, New Zealand Dental Association; The President, British Medical Association, N.S.W. Branch; Professor Harvey Sutton, Mrs. John Barr, B.D.S., Dr. P. C. Charlton, Professor A. J. Arnott. (2) that Dr. N. E. Goldsworthy be recommended to the General Meeting for appointment as an Honorary Member for 1950.

*Life Membership:* The President stated that several applications for life membership had been received and it was suggested that if life membership were granted it should be for retired members only as otherwise it would effect defence benefits.

It was resolved that this matter be referred to the new executive.

*Congress Commission:* From the report of the Congress Commission it was noted that a preliminary brochure had been forwarded to all members of the New South Wales Branch of the Australian Dental Association and copies to other State Branches for distribution to their members; that early next year a Congress Booklet will be forwarded to all dentists in Australia, the production cost of which will be covered by advertising; and that acting on advice received from the President of Congress, Dr. J. V. Hall Best, satisfactory progress had been made in regard to publicity and the entertainment programme.

#### REPORTS FROM COMMITTEES:

*Dental Health:* Mr. Tompson, the Chairman of the Dental Health Education Committee, reported that following the reference by the Executive Committee of the recommendation of the Delegates from Divisions relative to the dissemination of dental health propaganda, his Committee had considered the matter and made the following decisions:

- (1) That the Dental Health Education Committee appreciates the interest of the Delegates from Divisions in matters of dental health education.
- (2) That given adequate funds and support from the Executive this Department would be pleased to accede to the suggestions contained in the resolution of the 20th June, 1949, from the meeting of the Delegates from Divisions.

The Dental Essay Competitions' Prize Giving had been held on 26th October, 1949, when the attendance was smaller than in the past, partly due to the fact that there were no entries in the Pre-Leaving Certificate Section of the Roman Catholic Schools' Competition and that many of the award winners were from the country.

With regard to the 1950 Dental Essay Competition, Buddee and Crawford, Typists, cannot carry out the work involved as they found that this year's competitions occupied the full time of one member of their staff; enquiries are being made of other typing firms.

Bristol Meyers Pty. Ltd. have agreed to supplying an additional copy of the film, "Talking of Teeth", so that it can be circulated amongst the Greater Public and Associated Schools.

Consideration had been given to a report by Mr. Norton on Dental Health Activities in America and the Committee had made the following recommendations:—



- (1) That a recommendation be forwarded to the Executive that a method of disseminating dental health education per medium of dental divisions and groups be investigated.
- (2) That to implement this scheme, dentists be the prime movers in organising in each town, suburb and district, a committee of laymen to further the dental health of the community.

*Divisions:* Dr. Magnus reported that he and Mr. Norton had had a most successful visit to Wauchope on 5th and 6th November, 1949.

The question was raised as to when Divisions could nominate their representatives on the Executive and when the appointments would be made, in view of the Executive meeting on 22nd November, 1949.

It was resolved that Divisions be notified that the first meeting of the Executive will be held on 22nd November, 1949, after the election and that at that meeting consideration would be given to the appointment of nominees to represent Divisions and that they be requested to nominate their representatives before that date.

#### MEMBERSHIP:

*New Members:* It was resolved that the dental practitioners listed below whose applications were in order and who had paid the requisite subscriptions be admitted to membership of this State Branch as from 14th November, 1949:

Grattan, John Edward, B.D.S.; Knott, Bernays Melville, B.D.S.

*Deceased:* It was noted with regret that Dr. G. Satchell and Mr. A. S. Barnes were now deceased.

#### CORRESPONDENCE:

*Congress Grant:* Letter dated 27th October, 1949, from the Dental Board of New South Wales intimating that favourable consideration will be given to the granting of financial assistance towards the expense of an oversea lecturer on receipt of an estimate of the amount involved, was read and received.

*Holiday period, dental treatment:* Letter dated 19th October, 1949, from the Eastern Suburbs Dental Group relative to emergency dental treatment during the Christmas-New Year holiday period, was read.

It was resolved, (1) That the dental groups be asked to submit a roster of dentists who will be in attendance at their surgeries during the Christmas-New Year holiday period and that a notice be inserted in the various newspapers instructing the general public to telephone the Association's number in the event of their not being able to obtain urgent treatment. (2) That a notice be inserted in the December issue of the Dental Journal of Australia requesting city members to make reciprocal arrangements with each other for the carrying out of urgent treatment.

*Appreciation of work of staff:* It was resolved that the appreciation by the Executive Committee of the work carried out by the Secretary and Assistant Secretary, involving many hours additional work outside normal working hours, in connection with the Annual Report and Balance Sheet, be placed on record.

*Appreciation of work of President:* Dr. Helmore moved a vote of appreciation of the work carried out during the past two years by Mr. Edney in the capacity of President. Carried with acclamation.



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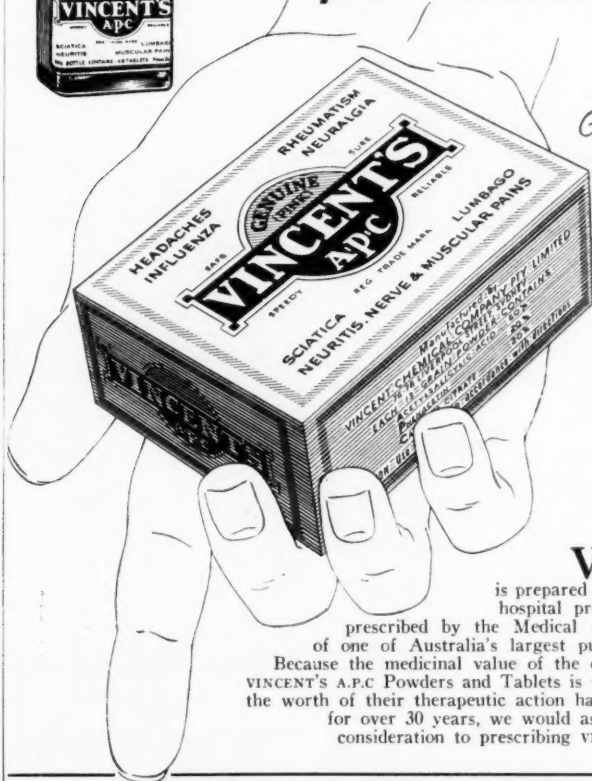
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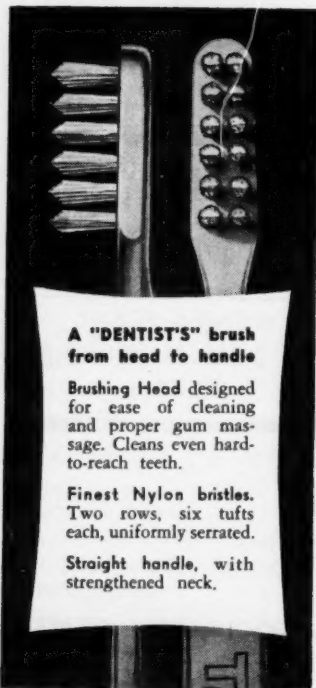
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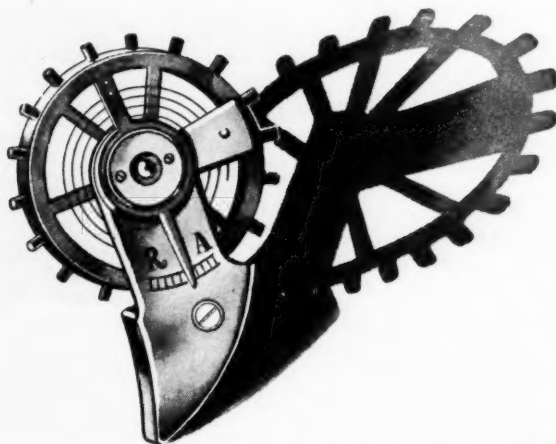
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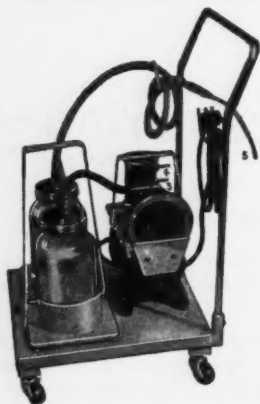
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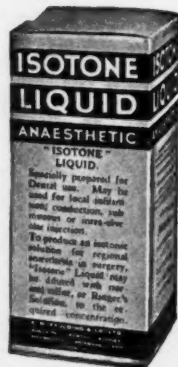
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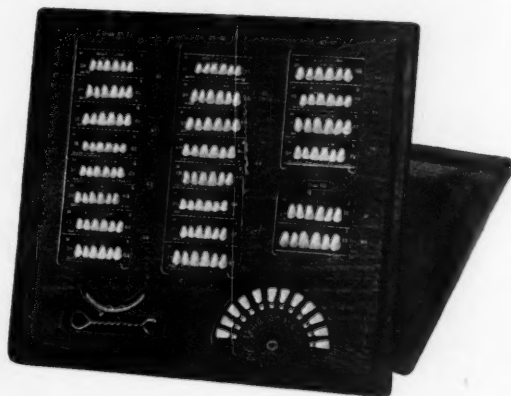


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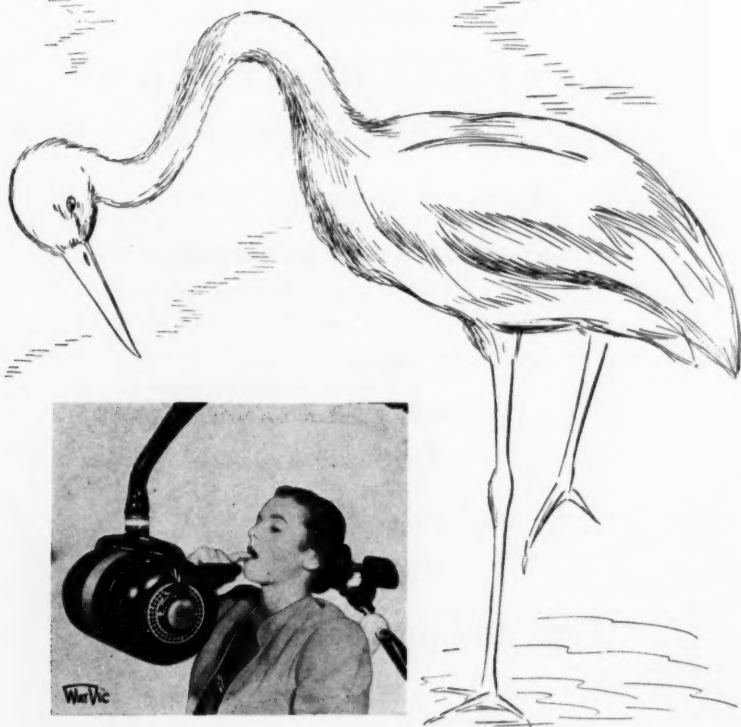


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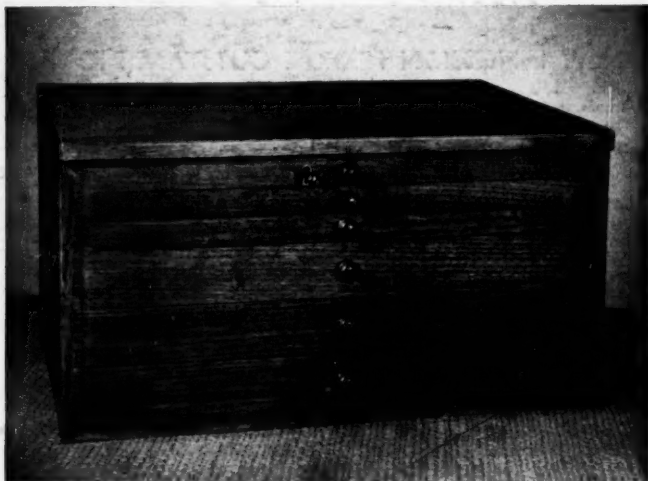
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